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II. Second Annual Report of the United States Geological Survey, 1880–'81, by J. W. Powell. 1882. 8°. lv, 588 pp. 61 pl. 1 map.

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VII. Seventh Annual Report of the United States Geological Survey, 1885–'86, by J. W. Powell. 1888. 8°. xx, 656 pp. 72 pl. and maps.

The Eighth and Ninth Annual Reports are in press.

MONOGRAPHS.

Monograph I is not yet published.

II. Tertiary History of the Grand Cañon District, with atlas, by Clarence E. Dutton, Capt. U. S. A. 1882. 4°. xiv, 264 pp. 42 pl. and atlas of 24 sheets folio. Price $10.12.

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XIII. Geology of the Quicksilver Deposits of the Pacific Slope, with atlas, by George F. Becker. 1888. 4°. xix, 486 pp. 7 pl. and atlas of 14 sheets folio. Price $2.00.

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—Geology of the Potomac Formation in Virginia, by W. M. Fontaine.

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4. On Mesozoic Fossils, by Charles A. White. 1884. 8°. 36 pp. 9 pl. Price 5 cents.

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50. Formulas and Tables to facilitate the construction and use of Maps, by R. S. Woodward.

51. Invertebrate Fossils from California, Oregon, Washington Territory, and Alaska, by C. A. White.

52. On the Subaërial Decay of Rocks and the Origin of the Red Color of Certain Formations, by Israel C. Russell.

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— On a Group of Volcanic Rocks from the Tewan Mountains, New Mexico, and on the occurrence of Primary Quartz in certain Basalts, by J. P. Iddings.

— On the relations of the Traps of the Jura-Trias of New Jersey, by N. H. Darton.

— Altitudes between Lake Superior and the Rocky Mountains, by Warren Upham.

— Mesozoic Fossils in the Permian of Texas, by C. A. White.

STATISTICAL PAPERS.

Mineral Resources of the United States [1882], by Albert Williams, jr. 1883. 8°. xvii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1883 and 1884, by Albert Williams, jr. 1885. 8°. xiv, 1016 pp. Price 60 cents.

Mineral Resources of the United States, 1885. Division of Mining Statistics and Technology. 1886. 8°. vii, 576 pp. Price 40 cents.

Mineral Resources of the United States, 1886, by David T. Day. 1887. 8°. viii, 813 pp. Price 50 cents.

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UNITED STATES GEOLOGICAL SURVEY
J. W. POWELL, DIRECTOR

LATITUDES AND LONGITUDES

OF

CERTAIN POINTS IN MISSOURI, KANSAS, AND NEW MEXICO

BY

ROBERT SIMPSON WOODWARD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1889

CONTENTS.

Page.

Letter of transmittal 7

(1) Determination of astronomical positions in Missouri, Kansas, and New Mexico 9

Descriptions of stations 9

(2) Oswego, Elk Falls, and Fort Scott, Kans.; Springfield and Bolivar, Mo.; Albuquerque, N. Mex 9

Instruments and instrumental constants 11

(3) Instruments used at Saint Louis and their constants 11

(4) Instruments used at the field stations and their constants 11

(5) Principal details of determination of constants of field instruments .. 12

Latitudes 20

(6) Methods of observation; selection of stars; table of results 20

(7) Combination of results from different pairs of stars by weights; table of definitive results 32

Longitudes 39

(8) Program for time determination 39

(9) Method of reduction 39

(10) Weights 41

(11) Details of time work 42

(12) Personal equation 43

(13) Time-piece corrections and rates 112

(14) Apparent differences of longitude 115

(15) Relations of apparent and true differences of longitude and systematic errors 120

(16) Derivation of longitude differences uncorrected for personal and instrumental equation 121

(17) Corrections for personal equation 123

(18) Transmission times; arrangement of circuits; instrumental equation. 128

(19) Adopted corrections for personal and instrumental equation 130

(20) Adopted longitudes 130

Table of geographical positions 132

(21) Derivation of geographical positions 132

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., April 15, 1887.

SIR: I have the honor to submit herewith, through Mr. Henry Gannett, Geologist in charge of Geography, a report on the determination of astronomic positions in Missouri, Kansas, and New Mexico.

The principal results of this work were furnished to the Division of Geography for use in the map work proper soon after the observations were made, and the definitive latitudes together with approximate longitudes of the primary points were published in the Sixth Annual Report of the Survey.

Although the immediate object of this astronomic work was the fixation of points within the probable limits of plumb line deflections, it is believed that the observations are sufficiently numerous and precise to justify their discussion somewhat in detail. Accordingly, in the intervals afforded by other work, an attempt has been made to collect, arrange, and discuss the observations in such a manner as to render their results most useful for the purposes of geography and geodesy.

I desire in this connection to acknowledge my indebtedness to Mr. B. C. Washington, jr., for faithful assistance in field work and in the office computations, of which latter he has made the greater part. It is proper also to state that the Survey is indebted for numerous courtesies to the county officials at Oswego and Fort Scott, Kans.; to Mr. S. E. W. Johnson, of Elk Falls, Kans.; to the authorities of Drury College, Springfield, and the Southwest Baptist College, Bolivar, Mo.; to the officials of the Atlantic and Pacific Railway, Albuquerque, N. Mex.; and to the Western Union Telegraph Company for the free use of their lines in exchanging clock signals.

Very respectfully,

R. S. WOODWARD,
Geographer.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

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LATITUDES AND LONGITUDES IN MISSOURI, KANSAS, AND NEW MEXICO.

By Robert S. Woodward.

(1) During the months August to December, 1885, and June and July, 1886, the latitudes and longitudes of the following places were determined in connection with the geographical work of the Geological Survey, namely, Oswego, Elk Falls, and Fort Scott, in Kansas; Springfield and Bolivar, in Missouri; and Albuquerque, in New Mexico. The results of this work are here collected and discussed with such detail as has seemed essential to their proper interpretation.

The longitudes of the above places were determined by the telegraphic method with respect to the observatory of Washington University, Saint Louis, Mo. The observations at Saint Louis were made by Prof. H. S. Pritchett. He was assisted by Mr. A. Ramel. The field observations were made by the writer, who was assisted by Mr. B. C. Washington, jr.

At each point where astronomic observations were made a stable and reasonably permanent pier for supporting the transit was erected. The piers were referred geodetically to one or more public buildings and to one or more public land survey corners. A list of the latitudes and longitudes of the latter points, as well as of the piers, will be found in section (21). Descriptions of the piers and the locations of the several stations where observations were made are given below.

DESCRIPTIONS OF STATIONS.

OSWEGO, KANS.

(2) This station is situated in the court house yard on the northwest corner of Sixth avenue and Merchant street, in Oswego, Labette County, Kans. The pier from which observations were made is about 3.5 feet high. It is of brick, two by two and one-half brick-lengths in cross section, and capped by a dressed sand stone about 19 inches by 24 inches in cross section and 6 inches thick. The foundation for the pier is a cubic yard of concrete whose upper surface is about even with the ground surface.

ELK FALLS, KANS.

This station is situated on the southwest corner of Sixth and Sedgewick streets in the village of Elk Falls, Elk County, Kans. It is about 75 feet west of the railway eating house and about 100 feet south of the Southern Kansas Railway. The pier is similar in form and construction to that at Oswego, described above.

FORT SCOTT, KANS.

This station is situated within and near the northeast corner of the court house square, Fort Scott, Bourbon County, Kans. This square is bounded on the north, east, south, and west by Birch street, National avenue, Hickory street, and Judson street, respectively. The pier is similar in form and construction to that at Oswego, described above. For the purpose of fixing a meridian line permanently the authorities of Bourbon County set in the court house square two heavy limestone posts. These are about 4 feet long, and are set so that their upper surfaces are about even with the ground surface. A point, consisting of an indentation made with a center punch in soft metal run into a hole one-half inch in diameter and 2 inches deep, was fixed on each stone. These points define a meridian with a probable error of about ± 10″. The point on the northern stone, which is near the north side of the square, bears north 8° 06′ west, and is 51.48 feet distant from the small drill hole defining the position of the transit on the capstone of the pier. The southern stone is 287.76 feet from the northern.

SPRINGFIELD, MO.

This station is situated in North Springfield, Greene County, Mo. It is on the grounds of Drury College, about 50 feet east of the center of Benton avenue, and between Calhoun and Center streets. The pier has a foundation of a cubic yard of concrete and a superstructure of dressed sandstone capped by a limestone slab 4 inches thick and 18 inches by 22 inches in cross section.

BOLIVAR, MO.

This station is situated in the northwest corner of the grounds of the Southwest Baptist College, Bolivar, Polk County, Mo. These grounds are bounded on the north, east, south, and west by Maupin, Mill, College, and Clarke streets, respectively. The foundation for the pier is a cubic yard of concrete. The superstructure is of brick capped by a limestone slab 4 inches thick and 18 inches by 22 inches in cross section.

ALBUQUERQUE, N. MEX.

This station is on the grounds of the Atlantic and Pacific Railway, Albuquerque, N. Mex. It is about 100 feet south of the general office of the railway company, and is inclosed by a small frame building or observatory. The pier is of dressed sandstone, about 16 inches square in cross section, about 7 feet long, and is capped by a limestone slab 6 inches thick and 19 inches by 24 inches in cross section.

INSTRUMENTS AND INSTRUMENTAL CONSTANTS.

(3) The instruments used at Saint Louis were a meridian transit by Fauth & Co., a chronograph by Bond & Sons, and two break-circuit mean-time clocks, Nos. 214 and 225, by Howard. For the transit, Professor Pritchett has furnished the following constants, which have been used in the reductions of his time work:

Meridian transit, Fauth & Co.

Focal length of telescope	inches	38.5
Clear aperture	do	[illegible]
Magnifying power	diameters	[illegible]

Equatorial intervals of diaphragm lines used from their mean.

$$\left.\begin{array}{lr} \text{Wire } A_3 & +11^s.41 \\ B_1 & +\ 5\ .70 \\ B_2 & +\ 2\ .85 \\ B_3 & 0\ .00 \\ B_4 & -\ 2\ .85 \\ B_5 & -\ 5\ .70 \\ C_1 & -11\ .41 \end{array}\right\} \text{Clamp west.}$$

Value of one division of striding level$=0^s.136$.

Inequality of pivots$=+0^s.005$ clamp west.

(4) The instruments used in the field were a meridian transit by Würdemann, a chronograph by Fauth & Co., and two break-circuit sidereal chronometers, No. 187 by Bond & Sons, and No. 353 by Blunt & Nichols. The transit has a split base, the lower part carrying a spindle, about which the upper part may turn when the instrument is used for determining latitude by Talcott's method. The constants of this transit are given below:

Meridian transit, Würdemann No. 20.

Focal length of telescope	inches	25.50
Clear aperture	do	2
Distance between principal points of objective	inch	0.123
Magnifying power with diagonal eye piece	diameters	70

Equatorial intervals of diaphragm lines from mean of middle five lines.[1]

Wire $A_1+25^s.72$
$A_2+21.51$
$A_3+17.16$
$1+\ 8.71\pm0^s.005$
$2+\ 4.37\pm0.005$
$3-\ 0.07\pm0.005$
$4-\ 4.30\pm0.005$
$5-\ 8.71\pm0.005$
$B_1-17.25$
$B_2-21.82$
$B_3-25.97$

Clamp west.

Table of level constants.

Levels.[1]	No. divisions to 1 inch.	Value of 1 division.
Striding level *A*	13	$1''.69=0^s.113$
Striding level *B*	20	$1.55=0.103$
Latitude level *C*	11	3.86
Latitude level *D*	12.5	2.10

[1] The letters *A*, *B*, *C*, *D*, respectively, are engraved on the glass tubes of these levels.

One revolution of zenith distance micrometer screw=$80''.763\pm0''.009$.

Log. half revolution=1.60618.5±4.5.

Correction for inequality of pivots[2]=$0^s.068$, the clamp end of the axis being the larger.

One revolution of azimuth screw=$198''.75=13^s.25$.

One division of head of screw for wye adjustment=$2''.08=0^s.139$.

(5) The principal details of the work of determining the above constants of Würdemann transit No. 20 will now be given.

(*a*) *Equatorial intervals of lines on diaphragm.*—The transit lines of this instrument are ruled on a glass diaphragm. The intervals of the five middle lines from their mean were determined from the transits, observed at Oswego, Kans., of 51 stars varying in declination from 0° to 87°. There were observed in all 161 transits of these stars. The resulting mean values of the intervals and their probable errors are those given above. The intervals of the outside lines from the mean of the middle five depend on a smaller number of transits, and have about half as great a precision as the other intervals.

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[1] The glass diaphragm on which these lines were ruled was, unfortunately, broken while the instrument was in the hands of the mechanician undergoing repairs in 1886.

[2] The pivots were re-turned and polished in 1886, and the existing pivot correction has not been determined.

The 161 transits of the 51 stars just mentioned afforded data for determining the probable error of a transit of a star across a single line or wire. If ε_1 denote the probable error corresponding to the aggregate of those actual errors whose effect varies as the secant of the star's declination, ε_2 the probable error corresponding to the aggregate of those actual errors whose effect is independent of the star's declination, and ε_δ the probable error of a transit over one wire of a star whose declination is δ; then

$$\varepsilon_1^2 \sec^2 \delta + \varepsilon_2^2 = \varepsilon_\delta^2.$$

By comparing the times of transit over the individual lines with the mean of those times a value of ε_δ was determined for each star. Considering ε_δ as the observed quantity and ε_1 and ε_2 as unknowns in the above equation, the usual process of least squares gave

$$\varepsilon_1^2 = (0^s.054)^2 \pm (0^s.004)^2,$$

$$\varepsilon_2^2 = (0^s.046)^2 \pm (0^s.025)^2.$$

These results give for the probable error of a transit of an equatorial star over one line

$$\varepsilon_0 = \pm 0^s.071.$$

In general, if m denote the magnifying power of a transit

$$\varepsilon_1 = \frac{k}{m},$$

in which k is a constant, or the value of ε_1 when $m=1$. Since for the transit used $m=70$, the above value of ε_1 gives

$$k = 3^s.78$$

Therefore we may write the general formula[1]

$$\varepsilon_\delta = \pm \sqrt{\left(\frac{3^s.78}{m}\right)^2 \sec^2 \delta + (0^s.05)^2}.$$

(*b*) *Focal length and magnifying power of telescope.*—The focal length of the telescope was determined by measuring the distance between an object and its image formed by the objective when the conjugate distances were about equal, or about twice the focal length sought. If f

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[1] Dr. Albrecht, in his Formeln und Hülfstafeln, gives

$$\varepsilon_\delta = \pm \sqrt{\left(\frac{3^s.18}{m}\right)^2 \sec^2 \delta + (0^s.05)^2}.$$

be the focal length of the objective and $2f\pm\Delta f_1$ and $2f\mp\Delta f_2$ be the conjugate distances, we get from the fundamental relation

$$\frac{1}{2f\pm\Delta f_1}+\frac{1}{2f\mp\Delta f_2}=\frac{1}{f},$$

$$\mp\frac{1}{4f}\left(\frac{\Delta f_1}{f}\right)+\frac{1}{8f}\left(\frac{\Delta f_1}{f}\right)^2\mp\quad\cdots$$

$$=\mp\frac{1}{4f}\left(\frac{\Delta f_2}{f}\right)-\frac{1}{8f}\left(\frac{\Delta f_2}{f}\right)^2\mp\quad\cdots;$$

whence, neglecting the higher terms,

$$\Delta f_1=\Delta f_2,$$

and hence

$$2f\pm\Delta f_1+2f\mp\Delta f_2=4f.$$

To get an idea of the magnitude of the neglected terms, suppose $f=25$ inches and $\Delta f=1$ inch, then

$$\frac{1}{8f}\left(\frac{\Delta f}{f}\right)^2=\frac{1}{50}\cdot\frac{1}{4f}\left(\frac{\Delta f}{f}\right).$$

Great accuracy therefore in centering the lens between the object and image is not essential. In the experiments, however, the values of Δf did not exceed one-half inch.

The object used was a pin hole in a black paper diaphragm. The hole was illuminated by daylight from a mirror and also by light from a lard-oil lamp. The image was observed with a microscope whose magnifying power is 33 diameters. The position of a fixed point on the microscope when focused on the plane of its stage was noted, and then the position of the same point relative to the stage was observed when the microscope was focused on the image of the pin hole. The position of the image relative to the microscope stage was thus known, and the only additional measurement was that of the distance of the plane of the microscope stage from the object. Six sets of measures were made, four when the pin hole was illuminated with light from the mirror and two when illuminated by the lamp. The front of the objective was toward the object for one-half of the measures and toward the image for the other half. The image was best defined when the front of the objective was toward the object, but in either case the image was as well defined as the image of a star formed by the same objective. No effect from spherical aberration was noticeable. The following are the results obtained for the distance between the object and image, the position of the objective being denoted by the letter *D* or *R*, according as its front was toward the object or image:

Distance.	Objective.	Light.
Inches.		
102.10	*D*	From mirror.
102.12	*D*	Do.
102.07	*R*	Do.
102.08	*R*	Do.
102.13	*R*	From lamp.
102.16	*D*	Do.

These results indicate some slight dependence on the position of the objective and on the color of the light used to illuminate the pin-hole, dependencies which would need examination in a more precise determination. For the present purposes, however, the arithmetical mean of the above results suffices. It is

$$102^{\text{in}}.11 \pm 0^{\text{in}}.01.$$

This is four times the focal length of the objective plus the distance between the principal points. The latter distance was measured with a microscope according to the method[1] given by Gauss in his Dioptrische Untersuchungen. The result was

$$0^{\text{in}}.123 \pm 0^{\text{in}}.001.$$

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[1] By this elegant method a microscope is focused on any object, first, when viewed directly; and, second, when viewed through the lens, the object being in the latter case in the axis of the lens and in contact with one of its exterior surfaces. The distance between the two positions of the microscope is then a measure of the distance between the principal points of the lens. The theory of this method, not given in detail by Gauss, is as follows:

Let P_1 and P_2 be the two positions of any point of the microscope tube when viewing an object, O, directly and through the lens, and E_1 and E_2 the positions of the principal points of the lens when it is in contact with the object. Let $P_1P_2 = s$, $E_1E_2 = \lambda$, $f =$ the focal length of the lens, $x =$ the conjugate distance OE_1, and y the corresponding distance from E_2 to the image, which will be in this case virtual. Then we have

$$s = x + \lambda + y,$$

or

$$\lambda = s - x - y.$$

But since

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{f}$$

$$x + y = -\frac{x^2}{f-x},$$

whence

$$\lambda = s + \frac{x^2}{f-x}.$$

Hence if x is small s is a close approximation to λ, or the distance between the principal points. For the Würdemann transit $f = 25^{\text{in}}.5$ and x does not exceed $0^{\text{in}}.1$. The small term in the above expression is therefore not greater than $\frac{1}{2500}$ inch.

Hence if f denote the focal length we have

$$4f=101^{\text{in}}.987\pm 0^{\text{in}}.010.$$

$$f=25^{\text{in}}.497\ \pm 0^{\text{in}}.003.$$

The magnifying power of the telescope was measured by the usual process, except that a micrometer microscope instead of a dynameter was used to measure the image of the objective formed by the eye piece.

(*c*) *Values of level divisions.*—The value of one division of each level was found by means of a level trier. For the use of an instrument of this kind the Survey is indebted to Prof. William Harkness, U. S. Navy, who placed his excellent trier at the writer's disposal and afforded every facility for securing comparisons between it and the levels. The observations were made in the usual manner and reduced as follows:

Let the differences between the readings of the ends of the bubble (whose graduations are numbered from the center towards either end) be denoted by $d_0, d_1, d_2 \ . \ . \ . \ d_n$, respectively. Let the corresponding readings of the level trier be denoted by R_0, $R_1 \ . \ . \ . \ R_n$, respectively. Supposing the errors of observation, etc., to exist in the values of d_1, d_2, etc., only, let the most probable corrections to these quantities be $v_0, v_1 \ . \ . \ . \ v_n$, respectively. Let y be the most probable value of one division of the level in terms of one division of the trier, and put

$$x=\frac{2}{y}.$$

Then

$$(R_\mu-R_0)x+v_0-(d_\mu-d_0)=v_\mu,$$

in which μ is any integer from 1 to n. Assuming the v's of equal weight, we must have $[vv]$ a minimum, subject to the n conditions symbolized by the last equation. Hence the normal equations for determining x and v_0 are

$$[R_\mu-R_0]x+[R_\mu-R_0]v_0=[(R_\mu-R_0)(d_\mu-d_0)],$$

$$[R_\mu-R_0]x+(n+1)v_0=[d_\mu-d_0].$$

The results obtained by this process are given in the following table:

Values of level divisions.

Date of determination.	Level.	Value of one division.	Temperature at time of comparisons.
1884.		″	F°.
August 4	*A*	1.67	84.0
August 5	*A*	1.71	78.5
August 4	*B*	1.53±0.01	84.0
August 5	*B*	1.58±0.01	78.5
August 4	*C*	3.86	84.0
August 4	*C*	3.86	84.0
August 5	*D*	2.09±0.02	78.5
August 5	*D*	2.00±0.01	78.5

The precision of the values for the levels *A* and *C*, whose probable errors have not been computed, is about the same as that for the levels *B* and *D*. The adopted values for levels *A* and *C* are means of those given in the table.

The value of a division of levels *B* and *D* was also determined in the field by comparisons with the zenith distance micrometer screw. The telescope of the transit was directed to a distant distinct object and given a slight motion in a vertical plane by means of the zenith distance tangent screw. This motion was measured with the levels and with the micrometer screw, thus affording a relation between them. The process of computation requisite to give the most probable value of a level division from such comparisons may be briefly explained thus:

Let

x=the value of one division of the level in terms of one division of the head of the micrometer screw.

a=observed number of level divisions over which the bubble moves for any motion of the level.

b=the corresponding number of micrometer divisions.

Then if Δa and v denote the most probable corrections to a and b, respectively, we have

$$(a+\Delta a)x-b=v,$$

which must be satisfied exactly by the computed values of x, Δa, and v. There will be as many equations of this form as there are different values of a or b. Subject to these equations we must also have, supposing the observed values of a and b of equal weight,

$$[\Delta a\,.\,\Delta a]x^2+[vv]=\text{a minimum.}$$

By forming the normal equations and eliminating the unknowns it may be readily shown that

$$x=\frac{[ab]}{[aa]}\text{ with the weight }[aa].$$

Also, if the successive values of a, b, Δa, and v be denoted by the suffixes 1, 2, . . . n,

$$\Delta a_1=\frac{b_1-a_1x}{2x},\qquad v_1=(a_1+\Delta a_1)x-b_1,$$

$$\Delta a_2=\frac{b_2-a_2x}{2x},\qquad v_2=(a_2+\Delta a_2)x-b_2,$$

$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots;$$

$$[a\Delta a]=0.\qquad [av]=0.$$

Finally, the probable error of an observed quantity of unit weight is

$$\pm 0.6745\sqrt{\frac{[vv]+[\Delta a\,.\,\Delta a]x^2}{n}}.$$

The reduction of the comparisons by the above process gave for one division of level *B*

$$1''.54\pm 0''.02,$$

and for level *D*

$$2''.15\pm 0''.02.$$

The temperature at the time of the comparisons was 50° F.

The values adopted for levels *B* and *D* are means of those derived from the comparisons with the level trier and those just given above. Thus the adopted value for level *B* is

$$\frac{\frac{1}{2}(1''.53+1''.58)+1''.54}{2}=1''.55,$$

and for level *D*

$$\frac{\frac{1}{2}(2''.09+2''.00)+2''.15}{2}=2''.10.$$

(*d*) *Value of one revolution of micrometer screw.*—The value of one revolution of the zenith distance micrometer screw was determined by transits of Polaris at elongation. The times of transits were recorded on the chronograph. The observations were treated by the method of least squares in the manner explained in Chauvenet's Astronomy, Volume II, section 237. Forty-one observation equations were furnished by the times of transit across the micrometer wire, which was set successively at each half revolution from 5.5 to 25.5. The solution of the equations gave for one revolution of the screw, corrected for differential refraction,

$$80''.763 \pm 0''.009.$$

An examination of the residuals gave no indication of systematic or large accidental irregularities in the screw. The above value has therefore been adopted.

(*e*) *Correction for inequality of pivots.*—The pivot correction was determined from several series of observations made especially for that purpose, and also from the working inclinations of the horizontal axis observed during the longitude work. The result from the direct observations is

$$p=0^s.068,$$

the clamp end of the axis being the larger. The mean value resulting from the working inclinations of 1884 is

$$p=0^s.060,$$

and that from similar data of 1885 is

$$p=0^s.070.$$

The result from the direct observations has been adopted.

The wye V's of the transit have different angles,[1] and this fact required a formula of reduction differing from those given in the books. If, in general, θ_1 and θ_2 are the half angles of the wye V's, i_1 and i_2 the half angles of the level V's, r_1 and r_2 the radii of the pivots, l the length of the level, and B_1 and B_2 the observed inclinations of the axis for clamp west and clamp east respectively,[2] then it may be shown that the following relation holds:

$$\frac{r_1-r_2}{l}\left\{\frac{1}{\sin i_1}+\frac{1}{\sin i_2}+\frac{1}{\sin \theta_1}+\frac{1}{\sin \theta_2}\right\}=B_1-B_2.$$

If the level V's have equal angles, i. e., if $i_1=i_2=i$, we have from this equation, since

$$p=\frac{r_1-r_2}{l \sin i},$$

$$p\left\{2+\frac{\sin i}{\sin \theta_1}+\frac{\sin i}{\sin \theta_2}\right\}=B_1-B_2.$$

This reduces to the usual form if $\theta_1=\theta_2$. See Chauvenet's Astronomy,

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[1] The old brass V's were replaced by agate surfaces in 1886.

[2] That is, the apparent inclination resulting from readings of the striding level in the direct and the reverse positions.

Vol. II, page 155. The numerical value of the coefficient of p in the last equation was found to be 4.07.

LATITUDES.

(6) Latitudes have been observed exclusively by Talcott's method. At each station a meridian mark was set up and its azimuth was determined within narrow limits from the time observations. By means of the meridian mark the middle line of the transit was kept closely collimated and in the meridian. With very few exceptions the stars were bisected at the time of transit across the middle line of the diaphragm.

Pairs of stars were selected for the most part from Safford's catalogue of 2018 stars.[1] Some few not embraced in this catalogue were selected from the catalogue of U. S. Coast and Geodetic Survey,[2] and a few from the Berliner Jahrbuch.

The observations of the stars selected from the Coast Survey catalogue have not been reduced, for the reasons that the catalogue furnishes approximate mean places only, and that too few were observed to make it worth while at present to examine the general catalogues for the purpose of deducing accurate mean places.

The details of the results which have been computed are given in Table I. The first column in these tables gives the dates of the observations. The second column gives the star numbers, these latter denoting those of Safford's catalogue, unless otherwise designated. The third and fourth columns give the declinations of the stars for the dates of observation, and the fifth column the half sum of the declinations for each pair. The sixth and seventh columns give the micrometer and level measurements, respectively, which together make up the half difference of zenith distances of the pairs of stars observed. The eighth column gives the correction for refraction, and the ninth column gives the result for latitude.

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[1] Mean declinations of 2018 stars between 0^h and 2^h and 12^h and 24^h right ascension, and 10° to 70° north declination, for January 1, 1875. Prepared under the direction of Lieut. George M. Wheeler, Corps Engineers, U. S. Army, Washington. Government Printing Office, 1879.

[2] Appendix No. 7, Report of 1876. Gvernment Printing Office, 1879.

TABLE I.—*Details of latitude work: Station, Oswego.*

Date.	Star number.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Sept. 3	672	690	28 29 54.10	46 04 31.89	37 17 12.98	— 7 12.80	—0.47	—0.12	37 09 59.59
4	672	690	54.12	31.93	13.02	— 7 13.82	+0.21	—0.12	59.29
3	701	714	27 47 43.25	46 40 51.82	37 14 17.53	— 4 19.25	+0.47	—0.07	58.68
4	701	714	43.26	51.87	17.56	— 4 19.85	+1.05	—0.07	58.69
3	721	726	29 16 03.02	45 29 27.57	37 22 45.28	—12 47.36	+1.83	—0.21	59.54
4	721	726	03.06	27.63	45.34	—12 38.36	—6.18	—0.21	60.59
4	732	739	48 28 26.09	26 05 14.06	37 16 50.08	— 6 55.53	+3.04	—0.12	57.47
Aug. 27	761	773	24 24 18.07	49 40 36.04	37 02 27.05	+ 7 33.48	—1.31	+0.12	59.34
Sept. 3	761	773	18.65	36.89	27.77	+ 7 32.43	—1.36	+0.12	58.96
4	761	773	18.68	36.99	27.83	+ 7 31.66	0.00	+0.12	59.61
Aug. 27	834	838	33 14 09.44	41 15 00.83	37 14 35.13	— 4 43.92	+7.50	—0.08	58.63
28	834	838	09.63	01.03	35.33	— 4 34.11	—1.52	—0.08	59.62
Sept. 3	834	838	10.33	01.83	36.08	— 4 36.78	—0.31	—0.08	58.91
4	834	838	10.42	01.94	36.18	— 4 35.40	+0.11	—0.08	60.81
Aug. 27	848	858	48 43 20.92	26 03 40.09*	37 23 30.50	—14 03.16	+0.73	—0.22	57.85
28	848	858	21.15	40.28	30.71	—13 59.85	+0.37	—0.22	61.01
Sept. 4	848	858	22.17	40.99	31.58	—14 03.76	+3.67	+0.52	61.27
Aug. 27	877	885	24 04 42.60	50 11 05.20	37 07 53.90	+ 1 59.76	+3.67	+0.03	57.36
Sept, 4	877	885	43.49	05.46	54.47	+ 2 05.87	—1.99	+0.03	58.38
Aug. 27	927	940	29 24 08.94	44 42 35.89	37 03 22.41	+ 6 35.42	+3.14	+0.11	61.08
28	927	940	09.14	36.16	22.65	+ 6 40.37	—2.26	+0.11	60.87
Sept. 3	927	940	09.96	37.21	23.58	+ 6 38.00	—0.68	+0.11	61.01
Aug. 27	974	977	44 26 47.70	29 53 38.43	37 10 13.06	— 0 16.51	+3.30	0.00	59.85
28	974	977	47.95	38.66	13.30	— 0 09.77	—3.72	0.00	59.81
Sept. 3	974	977	49.07	39.57	14.32	— 0 17.45	+4.30	0.00	61.17
4	974	977	49.22	39.67	14.44	— 0 14.86	+1.05	0.00	60.63
Aug. 27	996	1002	41 30 10.33	33 27 56.53	37 29 03.43	—19 07.26	+3.61	—0.34	59.44
28	996	1002	10.60	56.77	03.68	—19 02.10	—3.45	—0.34	57.79
Sept. 3	996	1002	11.72	57.78	04.76	—19 08.56	+3.40	—0.34	59.26
4	996	1002	11.87	57.89	04.88	—18 59.76	—3.72	—0.34	61.06
Aug. 27	1013	1040	22 19 22.92	52 08 20.45	37 13 51.68	— 3 53.49	+0.68	—0.07	58.80
Sept. 3	1013	1040	23.94	22.10	53.00	— 3 51.35	—1.31	—0.07	60.27
4	1013	1040	23.99	22.27	53.13	— 3 53.12	—1.31	—0.07	58.63
Aug. 28	1038	1046	34 46 60.22	40 03 51.48	37 25 25.85	—15 23.96	—1.00	—0.26	60.63
27	1075	1096	23 17 16.51	51 07 22.19	37 12 19.35	— 2 18.18	+0.37	—0.03	61.51
28	1075	1096	16.73	22.49	19.61	— 2 20.31	+3.61	—0.03	62.88
Sept. 3	1075	1096	17.60	23.94	20.77	— 2 19.16	—1.78	—0.03	59.80
4	1075	1096	17.70	24.13	20.91	— 2 20.32	—0.58	—0.03	59.98
Aug. 27	1117	1131	49 53 01.19	24 05 01.65	36 59 01.42	+11 02.17	—3.30	+0.19	60.48
28	1117	1131	01.52	01.87	01.69	+10 58.79	—2.31	+0.19	58.36
Sept. 3	1117	1131	02.95	02.84	02.89	+10 59.10	—3.98	+0.19	58.20
4	1117	1131	03.13	02.96	01.04	+11 02.04	—5.24	+0.19	60.03
Aug. 27	1144	1157	38 04 03.22	36 33 10.96	37 18 37.09	— 8 38.90	+0.94	—0.15	58.98
28	1144	1157	03.53	11.23	37.38	— 8 37.98	+1.36	—0.15	60.61
Sept. 3	1144	1157	04.82	12.50	38.66	— 8 37.53	+1.00	—0.15	61.98
4	1144	1157	04.98	12.66	38.82	— 8 38.69	+0.47	—0.15	60.45
Aug. 27	1192	1202	29 56 09.86	44 52 25.86	37 24 17.86	—14 17.73	—0.10	—0.24	59.79
28	1192	1202	10.13	26.17	18.15	—14 19.53	+3.30	—0.24	61.68
Sept. 4	1192	1202	11.43	27.85	19.64	—14 20.90	+0.89	—0.24	59.39

* The catalogue declination of 858 has been increased by 1′.

TABLE I.—*Details of latitude work: Station, Oswego.*—Continued.

Date.	Star number.	δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
					Micrometer.	Level.		
1884.		° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Aug. 27	1212 1233	30 18 14.94	43 57 21.10	37 07 48.02	+ 2 08.98	+1.89	+0.03	37 09 58.92
28	1212 1233	15.20	21.43	48.31	+ 2 13.10	−1.36	+0.03	60.08
Sept. 3	1212 1233	16.40	22.94	49.67	+ 2 10.39	−0.58	+0.02	59.51
4	1212 1233	16.55	23.14	49.84	+ 2 09.42	+0.58	+0.03	59.87
Aug. 28	1251 1267	21 53 06.75	52 49 53.37	37 21 30.06	−11 31.48	+2.15	−0.21	60.52
Sept. 3	1251 1267	07.77	55.14	31.45	−11 30.29	−1.05	−0.21	59.90
4	1251 1267	07.89	55.34	31.61	−11 29.60	−1.10	−0.21	60.70
Aug. 28	1295 1306	49 01 38.27	25 40 59.78	37 21 19.02	−11 18.81	+0.37	−0.20	60.38
Sept. 3	1295 1306	40.01	60.95	20.48	−11 23.66	+2.31	−0.20	58.93
4	1295 1306	40.23	61.11	20.67	−11 22.69	+1.89	−0.20	59.67
Aug. 28	1313 1336	36 37 13.02	38 01 17.53	37 19 15.27	− 9 19.47	+1.94	−0.15	57.59
Sept. 3	1320 1337	23 08 18.17	51 11 21.83	37 09 50.00	+ 0 11.87	−2.10	0.00	59.77
4	1320 1337	18.30	22.07	50.19	+ 0 08.56	+1.05	0.00	59.80
Aug. 28	1347 1370	49 16 46.23	25 07 09.63	37 11 57.93	− 1 57.51	−0.26	−0.03	60.13
Sept. 3	1360 1373	51 46 10.72	22 25 19.13	37 05 44.92	+ 4 14.16	+1.73	+0.07	60.88
Aug. 28	1380 1397	48 46 47.67	25 23 12.43	37 05 00.05	+ 4 57.13	+1.62	+0.09	58.89
Sept. 3	1380 1397	49.48	13.71	01.59	+ 4 58.90	−0.10	+0.09	60.48
4	1380 1397	49.73	13.85	01.79	+ 4 59.06	−1.05	+0.09	59.89
Aug. 28	1410 1424	46 02 50.05	28 24 28.07	37 13 39.06	− 3 38.71	−1.41	−0.06	58.88
Sept. 3	1410 1424	51.85	29.43	40.64	− 3 39.27	−0.52	−0.06	60.79
4	1410 1424	52.09	29.61	40.85	− 3 40.28	+0.42	−0.06	60.93
Aug. 28	1461 1465	37 10 40.99	37.11 37.49	37 11 09.24	− 1 11.15	+1.73	−0.02	59.80
Sept. 3	1461 1465	42.61	39.12	10.86	− 1 14.30	+1.68	−0.02	58.22
4	1461 1465	42.82	39.34	11.08	− 1 14.50	+3.67	−0.02	60.23
Aug. 28	1512 1535	44 35 11.25	29 51 01.38	37 13 06.31	− 3 07.29	−0.05	−0.05	58.92
Sept. 3	1512 1535	13.09	02.86	07.97	− 3 08.18	+1.05	−0.05	60.79
4	1512 1535	13.35	03.05	08.20	− 3 07.05	−0.79	−0.05	60.31
Aug. 28	1598 1616	26 13 37.08	47 59 39.33	37 06 38.20	+ 3 17.14	+4.87	+0.06	60.27
Sept. 3	1598 1616	38.48	41.29	39.88	+ 3 18.07	+2.04	+0.06	60.05
Aug. 28	1633 1640	31 53 56.48	42 16 43.13	37 05 19.80	+ 4 41.18	−2.46	+0.08	58.60
Sept. 3	1633 1640	58.07	44.95	21.51	+ 4 38.23	+0.37	+0.08	60.19
Aug. 28	1675 1682	46 11 34.35	28 12 07.76	37 11 51.05	− 1 51.82	+0.52	−0.03	59.72
Sept. 3	1675 1682	36.27	09.24	52.75	− 1 55.90	+3.93	−0.03	60.75
Aug. 28	1723 1728	28 23 11.03	45 44 48.63	37 03 59.83	+ 5 57.37	+2.10	+0.12	59.42
28	1789 1804	53 31 55.00	20 48 23.93	37 10 09.46	− 0 10.21	+1.57	0.00	60.82
Sept. 3	1789 1804	56.94	25.16	11.05	− 0 13.73	+3.67	0.00	60.99
Aug. 28	1814 1831	47 13 52.47	27 04 57.47	37 09 24.97	+ 0 32.51	+3.04	+0.01	60.53
Sept. 3	1814 1831	54.30	58.86	26.58	+ 0 34.53	−1.31	+0.01	59.81

TABLE I.—*Details of latitude work: Station, Elk Falls.*

Date.	Star number.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$.		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Oct 1	848	858	48 43 24.48	26 03 42.63*	37 23 33.55	− 2 03.01	+3.25	−0.03	37 22 03.76
1	869	879	21 06 19.92	53 13 40.06	37 09 59.99	+12 05.82	−1.41	+0.22	04.62
1	890	912	21 22 02.66	53 09 49.94	37 15 56.30	+ 6 07.67	−1.41	+0.11	02.67
1	957	970	58 21 36.97	16 12 38.12	37 17 07.56	+ 4 52.77	+2.62	+0.09	03.04
1	977	987	29 53 42.34	45 15 34.86	37 34 38.60	−12 33.80	−0.21	−0.21	04.38
1	996	1002	41 30 15.36	33 28 00.92	37 29 08.14	− 7 02.63	−1.52	−0.12	03.87
7	996	1002	15.74	01.25	08.49	− 7 01.50	−3.83	−0.12	03.04
1	1013	1022	22 19 26.40	52 42 11.87	37 30 49.13	− 8 48.19	+1.73	−0.16	02.51
7	1013	1022	26.62	12.40	49.51	− 8 37.89	−8.49	−0.16	02.97
1	1038	1046	34 47 04.81	40 03 56.55	37 25 30.68	− 3 25.14	−1.21	−0.06	04.27
7	1038	1046	05.20	56.99	31.09	− 3 27.52	−0.47	−0.06	03.04
1	1142	1168	54 18 52.23	20 35 49.35	37 27 20.79	− 5 16.99	+0.47	−0.09	04.18
7	1123	1133	34 37 47.85	39 53 43.49	37 15 45.67	+ 6 18.78	−0.05	+0.11	04.51
4	1151	1180	48 32 34.80	26 04 03.32	37 18 19.06	+ 3 43.71	−0.79	+0.06	02.04
4	1192	1202	29 56 15.50	44 52 33.39	37 24 24.44	− 2 20.37	−1.05	−0.04	02.98
7	1192	1202	15.79	33.80	24.79	− 2 21.98	+1.26	−0.04	04.03
1	1207	1209	49 56 00.00	24 51 52.56	37 23 56.28	− 1 56.95	+2.36	−0.03	01.66
4	1211	1229	46 53 09.76	27 49 30.15	37 21 19.95	+ 0 41.92	+1.26	+0.01	03.14
1	1225	1235	47 24 51.33	27 37 33.01	37 31 12.17	− 9 08.78	+0.79	−0.15	04.03
5	1225	1235	51.85	33.31	12.58	− 9 10.64	+0.26	−0.15	02.05
1	1251	1267	21 53 11.23	52 50 01.67	37 21 36.45	+ 0 28.67	−1.36	+0.01	03.77
4	1251	1267	11.40	02.13	36.76	+ 0 25.40	+0.42	0.00	02.58
5	1251	1267	11.48	02.30	36.89	+ 0 26.73	−0.05	0.00	03.57
5	1294	1299	55 19 14.86	19 19 02.03	37 19 08.44	+ 2 53.84	+1.21	+0.05	03.54
1	1295	1306	49 01 46.61	25 41 05.24	37 21 25.92	+ 0 38.77	−0.21	+0.01	04.49
4	1302	1306	48 54 07.17	25 41 05.47	37 17 36.32	+ 4 27.28	+0.05	+0.08	03.73
1	1312	1332	27 06 45.88	47 56 28.48	37 31 37.18	− 9 33.26	+0.05	−0.16	03.81
4	1313	1336	36 37 20.43	38 01 25.33	37 19 22.88	+ 2 41.48	−1.21	+0.04	03.19
5	1313	1336	20.58	25.49	23.03	+ 2 40.48	−0.63	+0.04	03.32
Sept. 21	1347	1370	49 16 52.80	25 07 13.95	37 12 03.37	+ 9 58.69	+2.41	+0.17	04.64
24	1371	1376	58 15 26.41	16 39 59.45	37 27 42.93	− 5 42.19	+3.41	−0.10	04.05
29	1371	1376	27.72	59.96	43.84	− 5 40.13	+1.57	−0.10	05.18
Oct. 1	1371	1376	28.11	60.09	44.10	− 5 39.73	+0.16	−0.10	04.43
4	1371	1376	28.72	60.23	44.47	− 5 39.73	+0.10	−0.10	04.74
5	1373	1390	22 25 23.55	52 09 55.58	37 17 39.56	+ 4 24.13	+0.10	+0.08	03.87
Sept. 24	1392	1399	19 17 29.63	55 15 38.16	37 16 33.89	+ 5 29.95	+0.79	+0.10	04.73
29	1392	1399	30.22	39.47	34.84	+ 5 29.50	+0.52	+0.10	05.05
Oct. 1	1302	1399	30.37	39.86	35.12	+ 5 26.29	+3.72	+0.10	05.23
Sept. 21	1396	1410	28 15 34.07	46 02 56.60	37 09 15.33	+12 48.46	0.00	+0.22	04.01
Oct. 4	1392	1402	19 17 30.56	55 40 31.49	37 29 01.02	− 6 58.87	+1.68	−0.13	03.70
Sept. 21	1420	1440	42 15 47.85	32 37 03.11	37 26 25.48	− 4 21.02	+0.47	−0.07	04.66
24	1420	1440	48.57	03.74	26.15	− 4 20.46	−1.68	−0.07	03.94
Oct. 1	1420	1440	50.02	04.96	27.49	− 4 22.80	−1.89	−0.07	02.73
4	1423	1444	59 15 42.07	15 28 39.73	37 22 10.90	− 0 09.13	+3.14	0.00	04.91
5	1423	1444	42.33	39.81	11.07	− 0 08.88	+1.78	0.00	03.97
8	1423	1444	43.02	40.10	11.56	− 0 10.50	−0.16	0.00	00.90
Oct. 1	1464	1480	19 23 30.37	55 23 07.39	37 23 18.88	− 1 16.76	+1.73	−0.02	03.83
4	1473	1494	27 45 18.55	47 07 19.66	37 26 19.10	− 4 14.40	−1.99	−0.07	02.64
8	1473	1494	19.15	20.61	19.88	− 4 18.20	+1.57	−0.07	03.18

* The catalogue declination of 858 has been increased by 1′.

TABLE I.—*Details of latitude work: Station, Elk Falls*—Continued.

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Sept. 24	1493	1498	31 59 14.67	42 32 14.26	37 15 44.46	+ 6 13.33	+3.72	+0.10	37 22 01.61
29	1493	1498	15.68	15.48	45.58	+ 6 18.13	+0.73	+0.10	04.54
Oct. 1	1493	1498	15.95	15.86	45.90	+ 6 21.80	−3.83	+0.10	03.97
Sept. 21	1512	1535	44 35 18.06	29 51 06.64	37 13 12.35	+ 8 51.83	+0.21	+0.15	04.54
24	1512	1535	18.85	07.24	13.04	+ 8 51.83	+1.47	+0.15	06.49
29	1512	1535	20.14	08.21	14.17	+ 8 46.57	+0.10	+0.15	00.99
Oct. 1	1512	1535	20.55	08.51	14.53	+ 8 46.45	+3.56	+0.15	04.69
4	1512	1535	21.12	08.88	15.00	+ 8 47.83	+0.05	+0.15	03.03
8	1512	1535	22.05	09.54	15.79	+ 8 48.22	−0.10	+0.15	04.06
Sept. 21	1559	1565	35 44 24.72	38 41 47.80	37 13 06.26	+ 8 59.50	−1.47	+0.15	04.44
24	1559	1565	25.41	48.56	06.98	+ 8 59.01	−3.14	+0.15	03.00
29	1559	1565	26.55	49.76	08.15	+ 8 59.66	−2.46	+0.15	05.50
Oct. 1	1559	1565	26.88	50.14	08.51	+ 8 57.84	−3.46	+0.15	03.04
4	1562	1575	20 09 18.86	54 37 13.33	37 23 16.09	− 1 12.40	−1.31	−0.02	02.36
8	1562	1575	19.35	14.45	16.90	− 1 13.25	+1.05	−0.02	04.68
Sept. 24	1583	1602	24 51 00.40	49 59 39.26	37 25 19.83	− 3 14.44	−1.47	−0.05	03.87
29	1583	1602	01.28	40.74	21.01	− 3 15.24	−2.36	−0.05	03.36
Oct. 1	1583	1602	01.52	41.21	21.36	− 3 18.47	+0.47	−0.05	03.31
4	1598	1611	26 13 44.12	48 23 23.04	37 18 33.58	+ 3 29.46	−0.47	+0.06	02.63
8	1598	1611	44.76	24.10	34.43	+ 3 29.58	+0.31	+0.06	04.38
Sept. 24	1609	1621	44 32 25.23	29 47 22.28	37 09 53.75	+12 12.00	−1.41	+0.21	04.55
29	1609	1621	26.64	23.32	54.98	+12 06.86	+3.14	+0.21	05.19
Oct. 1	1609	1621	27.07	23.61	55.34	+12 08.80	−0.10	+0.21	04.25
4	1623	1628	43 29 26.17	31 11 05.88	37 20 16.02	+ 1 42.81	+4.14	+0.03	03.00
8	1623	1628	27.14	06.62	16.88	+ 1 47.54	−0.68	+0.03	03.77
Sept. 24	1640	1652	42 16 50.70	32 51 46.13	37 34 18.41	−12 15.06	−0.05	−0.21	03.09
29	1640	1652	52.05	47.26	19.65	−12 13.28	−1.78	−0.21	04.38
Oct. 1	1640	1652	52.48	47.62	20.05	−12 18.28	+2.78	−0.21	04.34
4	1650	1656	30 41 34.02	43 47 43.35	37 14 38.68	+ 7 24.64	−0.79	+0.13	02.66
8	1650	1656	34.76	44.34	39.55	+ 7 25.97	−2.41	+0.13	03.24
Sept. 24	1669	1675	28 43 34.09	46 11 42.34	37 27 38.21	− 5 27.97	−5.97	−0.09	04.18
29	1669	1675	35.11	43.82	39.46	− 5 34.40	−2.31	−0.09	02.66
Oct. 1	1669	1675	35.42	44.29	39.85	− 5 33.71	−2.57	−0.09	03.48
4	1669	1675	35.84	44.97	40.40	− 5 35.57	−0.58	−0.09	04.16
8	1669	1675	36.53	46.01	41.27	− 5 36.25	+0.21	−0.09	05.14

TABLE I.—*Details of latitude work: Station, Fort Scott.*

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Oct. 16	1060	1076	24 29 15.45	51 31 01.19	38 00 08.32	− 9 44.52	+1.41	−0.17	37 50 25.04
16	1170	1174	34 51 48.83	40 42 30.94	37 47 09.88	+ 3 13.59	+1.83	+0.05	25.35
28	1170	1174	49.02	31.25	10.13	+ 3 18.96	−3.77	+0.05	25.37
16	1183	1202	31 10 36.87	44 52 34.59	38 01 35.73	−11 09.25	−1.15	−0.19	25.14
27	1183	1202	37.06	35.08	36.07	−11 10.78	+0.26	−0.19	25.36
29	1203	1217	41 18 42.37	33 57 28.76	37 38 05.56	+12 20.83	−0.58	+0.20	26.01
16	1212	1223	30 18 21.64	45 09 51.30	37 44 06.47	+ 6 21.88	−2.04	+0.11	26.42
27	1212	1223	21.88	51.90	06.89	+ 6 19.34	−0.58	+0.11	25.76
28	1212	1223	21.84	51.87	06.85	+ 6 22.45	−2.57	+0.11	26.84
16	1241	1251	54 04 56.34	21 53 12.06	37 59 04.20	− 8 40.07	−0.21	−0.15	23.77
28	1252	1257	56 27 06.09	18 53 17.95	37 40 12.02	+10 16.41	−0.31	+0.17	28.29
29	1252	1257	06.11	17.88	11.99	+10 14.92	−0.68	+0.17	26.40
16	1259	1264	47 04 42.34	28 38 34.45	37 51 38.39	− 1 14.46	−0.10	−0.02	23.81
31	1259	1264	43.11	34.71	38.91	− 1 13.98	−0.21	−0.02	24.70
28	1261	1274	45 42 38.68	29 44 47.42	37 43 43.05	+ 6 43.00	−1.73	+0.12	24.44
29	1261	1274	38.67	47.42	43.04	+ 6 41.31	+1.31	+0.12	25.78
16	1270	1286	38 11 23.95	37 33 38.36	37 52 31.15	− 2 04.29	−0.63	−0.03	26.20
27	1270 1271	1286	24.67 14.31	39.05	29.27	− 2 01.67	−0.21	−0.03	27.36
31	1270 1271	1286	24.66 14.29	39.03	29.25	− 2 03.00	+0.26	−0.03	26.48
16	1296	1314	23 22 35.88	52 24 18.54	37 53 27.21	− 3 04.10	+1.99	−0.05	25.05
27	1296	1314	36.23	19.79	28.01	− 3 04.18	+1.73	−0.05	25.51
31	1296	1314	36.12	19.94	28.03	− 3 00.83	−2.31	−0.05	24.84
28	1302	1312	48 54 10.16	27 06 47.72	38 00 28.94	−10 02.60	−0.42	−0.17	25.75
16	1320	1326	23 08 23.34	52 27 28.53	37 47 55.93	+ 2 30.46	−0.52	+0.04	25.91
27	1320	1326	23.75	29.82	56.78	+ 2 29.41	−0.10	+0.04	25.13
28	1320	1326	23.73	29.87	56.80	+ 2 28.81	+0.42	+0.04	26.07
31	1320	1326	23.65	30.00	56.82	+ 2 29.33	−0.52	+0.04	25.67
16	1339	1350	18 48 21.06	56 58 29.38	37 53 25.22	− 3 00.38	+0.89	−0.05	25.68
24	1339	1350	21.39	30.61	26.00	− 3 01.15	+0.58	−0.05	25.38
27	1339	1350	21.37	30.91	26.14	− 2 59.25	−0.42	−0.05	26.42
31	1339	1350	21.26	31.17	26.21	− 3 01.88	+1.21	−0.05	25.49
16	1359	1372	50 40 14.27	25 03 29.92	37 51 52.09	− 1 27.02	+0.31	−0.03	25.35
24	1359	1370	15.38	07 17.22	37 53 46.30	− 3 20.17	+1.36	−0.06	27.43
27	1359	1370	15.65	17.27	46.46	− 3 24.29	+0.05	−0.06	22.16
30	1359	1370	15.79	17.24	46.51	− 3 22.71	+1.15	−0.06	24.89
31	1359	1370	15.86	17.22	46.54	− 3 20.29	−0.79	−0.06	25.40
27	1386	1410	29 38 38.39	46 03 02.95	37 50 50.67	− 0 23.18	−1.78	−0.01	25.70
31	1386	1410	38.40	03.18	50.79	− 0 26.01	+0.31	−0.01	25.08
16	1424	1438	28 24 36.30	47 22 34.86	37 53 35.58	− 3 05.99	−2.20	−0.05	27.34
27	1424	1438	37.12	36.42	36.77	− 3 12.38	+1.00	−0.05	25.34
30	1424	1438	37.15	36.64	36.89	− 3 11.17	−0.68	−0.05	24.99
31	1424	1438	37.17	36.72	36.94	− 3 08.82	−2.10	−0.05	25.97
28	1450	1464	56 16 24.06	19 23 32.16	37 49 58.11	+ 0 26.53	+3.83	−0.01	28.46
30	1450	1464	24.26	32.13	58.19	+ 0 27.86	+0.37	−0.01	26.41
27	1460	1464	56 28 32.57	19 23 32.14	37 56 02.35	− 5 37.91	+1.73	−0.09	26.08
31	1460	1464	32.99	32.50	02.74	− 5 36.38	+1.31	−0.09	27.58
23	1493	1514	31 59 19.31	43 43 08.06	37 51 13.68	− 0 45.75	−0.37	−0.01	27.55
27	1500	1502	19 38 28.77	56 02 06.10	37 50 17.43	+ 0 10.01	−2.67	0.00	24.77
31	1500	1502	28.75	06.60	17.67	+ 0 10.10	−3.20	0.00	24.57

TABLE I.—*Details of latitude work: Station, Fort Scott*—Continued.

Date.	Star numbers.	δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
					Micrometer.	Level.		
1884.		° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Oct. 16	1534 1541	51 55 00.61	23 59 52.72	37 57 26.66	− 7 03.60	+1.89	−0.12	37 50 24.83
28	1535 1539	29 51 11.81	45 36 52.97	37 43 62.39	+ 6 28.79	−3.77	+0.11	27.52
28	1543 1562	55 17 51.10	20 09 20.85	37 43 35.97	+ 6 48.54	+0.58	+0.11	25.20
16	1558 1559	39 46 03.34	35 44 29.52	37 45 16.43	+ 5 07.63	+1.15	+0.09	25.30
31	1558 1559	05.34	31.26	18.30	+ 5 07.74	−0.79	+0.09	25.34
27	1563 1576	48 04 27.43	27 27 46.21	37 46 06.82	+ 4 17.55	+1.41	+0.07	25.85
31	1563 1576	27.91	46.38	07.14	+ 4 17.72	+0.94	+0.07	25.87
16	1579 1598	49 25 50.99	26 13 48.02	37 49 49.50	+ 0 38.20	−1.52	+0.01	26.19
27	1579 1598	53.13	49.11	51.12	+ 0 33.31	+2.46	+0.01	26.90
28	1579 1598	53.29	49.17	51.23	+ 0 37.55	−0.52	+0.01	28.27
30	1579 1598	53.53	49.24	51.38	+ 0 32.31	+1.99	+0.01	25.69
31	1579 1598	53.66	49.28	51.47	+ 0 34.89	+0.84	+0.01	27.21
28	1604 1621	45 54 09.28	29 47 27.33	37 50 48.30	− 0 24.19	+0.37	−0.01	24.47
16	1608 1619	52 35 48.91	23 06 49.51	37 51 19.21	− 0 53.95	+0.37	−0.02	25.61
31	1608 1619	51.89	50.60	21.24	− 0 56.05	+0.58	−0.02	25.75
16	1636 1647	31 45 22.77	43 26 25.82	37 35 54.29	+14 32.52	−0.68	+0.24	26.37
27	1636 1647	24.20	27.87	56.03	+14 32.14	−6.08	+0.24	22.33
28	1645 1658	57 55 08.55	17 45 57.44	37 50 32.99	− 0 05.77	−1.31	0.00	25.91
30	1645 1658	08.90	57.45	33.18	− 0 05.25	−2.20	0.00	25.73
16	1668 1687	57 25 46.64	18 29 01.91	37 57 24.27	− 7 01.75	−1.15	−0.12	21.25
28	1668 1687	49.58	02.72	26.15	− 7 03.12	+0.79	−0.12	23.70
16	1703 1707	49 48 07.01	26 16 54.81	38 02 30.91	−12 05.14	+0.32	−0.20	25.89
28	1703 1707	09.70	56.13	32.91	−12 14.09	+9.38	−0.20	28.00
16	1718 1727	57 53 38.05	17 34 28.25	37 44 03.15	+ 6 23.93	−2.04	+0.11	25.20
27	1718 1727	40.97	29.01	04.99	+ 6 17.00	+2.46	+0.11	24.56
31	1718 1727	41.80	29.08	05.44	+ 6 21.16	+0.79	+0.11	27.50
28	1723 1735	28 23 22.04	47 30 53.01	37 57 07.52	− 6 38.16	−4.51	−0.11	24.74
30	1725 1743	28 27 29.16	47 18 37.12	37 53 03.14	− 2 40.96	+2.46	−0.04	24.60
16	1744 1752	38 02 42.64	37 20 00.53	37 41 21.58	+ 9 04.90	+0.37	+0.15	27.00
27	1744 1752	44.61	02.47	23.54	+ 9 00.95	+1.94	+0.15	26.58
28	1744 1752	44.75	02.61	23.68	+ 9 04.34	−0.47	+0.15	27.70
31	1744 1752	45.12	02.97	24.04	+ 9 05.31	+0.73	+0.15	30.23
16	1762 1782	56 08 44.33	19 39 44.55	37 54 14.44	− 3 46.21	−2.04	−0.06	26.13
31	1762 1782	48.13	45.59	16.86	− 3 47.35	−0.63	−0.06	28.82
16	1792 1801	26 37 20.69	48 43 25.13	37 40 22.91	+10 02.37	+0.42	+0.17	25.87
28	1800 1814	28 41 21.08	47 14 08.92	37 57 45.00	− 7 18.42	−0.58	−0.12	25.88
31	1800 1814	21.32	09.44	45.38	− 7 23.92	+2.31	−0.12	23.65
16	1815 1827	47 39 22.01	28 05 37.40	37 52 29.70	− 2 00.94	−2.36	−0.03	26.37
28	1833 1853	50 56 50.93	24 40 28.11	37 48 39.52	+ 1 44.67	+1.31	+0.03	25.53
28	1857 1887	53 35 23.57	22 06 43.24	37 51 03.40	− 0 37.47	−0.16	−0.01	25.76

TABLE I.—*Details of latitude work: Station, North Springfield.*

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Nov. 8	1396	1410	28 15 38.28	46 03 03.84	37 09 21.06	+ 3 53.97	+0.58	+0.07	37 13 15.68
8	1425	1454	46 40 51.06	28 02 35.59	37 21 43.33	− 8 25.45	−4.09	−0.14	13.65
9	1425	1454	51.10	35.59	43.34	− 8 31.02	+3.30	−0.14	15.48
10	1425	1454	51.11	35.55	43.33	− 8 30.50	+0.73	−0.14	13.42
8	1461	1465	37 10 53.35	37 11 50.01	37 11 21.68	+ 1 54.64	+0.84	+0.03	17.19
9	1461	1465	53.39	50.03	21.71	+ 1 55.57	−1.26	+0.03	16.05
10	1461	1465	53.40	50.05	21.72	+ 1 54.44	+1.26	+0.03	17.45
8	1493	1498	31 59 19.99	42 32 21.41	37 15 50.70	− 2 32.24	−3.20	−0.04	15.22
9	1493	1498	20.01	21.46	50.73	− 2 36.64	+0.73	−0.04	14.78
10	1493	1498	20.02	21.50	50.76	− 2 31.03	−2.99	−0.04	16.70
10	1522	1528	44 24 47.54	29 37 27.54	37 01 07.54	+12 06.13	+3.77	+0.20	17.64
8	1525	1539	28 42 42.31	45 36 55.99	37 09 49.15	+ 3 27.08	−0.21	+0.06	16.08
9	1525	1539	42.34	56.06	49.20	+ 3 26.83	+0.10	+0.06	16.19
8	1541	1546	23 59 54.13	50 04 23.98	37 02 09.05	+11 07.82	−0.58	+0.19	16.48
9	1541	1546	54.16	24.10	09.13	+11 06.28	+1.05	+0.19	16.65
10	1541	1546	54.15	24.16	09.15	+11 06.61	−0.63	+0.19	15.32
8	1562	1575	20 09 21.23	54 37 20.77	37 23 21.00	−10 04.02	−1.36	−0.17	15.45
9	1562	1575	21.26	20.90	21.08	−10 08.02	+0.58	−0.17	13.47
10	1562	1575	21.24	20.99	21.12	−10 04.27	−0.94	−0.17	15.74
8	1579	1583	49 25 54.91	24 51 05.10	37 08 30.00	+ 4 44.56	+0.63	+0.08	15.27
9	1579	1583	55.03	05.14	30.08	+ 4 47.59	−3.20	+0.08	14.55
10	1579	1583	55.13	05.14	30.13	+ 4 47.03	−1.99	+0.08	15.25
8	1589	1598	48 40 27.02	26 13 47.64	37 27 07.33	−13 52.05	−0.31	−0.24	14.73
9	1589	1598	27.15	47.69	07.42	−13 52.74	+1.05	−0.24	15.49
10	1589	1598	27.23	47.71	07.47	−13 53.66	+1.26	−0.24	14.83
8	1609	1621	44 32 34.12	29 47 28.24	37 10 01.18	+ 3 15.69	−0.31	+0.06	16.62
9	1609	1621	34.23	28.31	01.27	+ 3 15.41	−1.10	+0.06	15.64
10	1609	1621	34.33	28.36	01.34	+ 3 14.56	−0.21	+0.06	15.75
8	1633	1640	31 54 09.27	42 16 59.39	37 05 34.33	+ 7 42.17	−0.21	+0.13	16.42
9	1633	1640	09.36	59.51	34.43	+ 7 43.25	−2.46	+0.13	15.35
10	1636	1640	31 45 25.42	59.60	37 01 12.51	+12 03.67	+2.10	+0.20	18.48
8	1650	1656	30 41 38.58	43 47 50.07	37 14 44.33	− 1 26.09	−1.62	−0.03	16.59
9	1650	1656	38.66	50.20	44.43	− 1 29.00	+0.94	−0.03	16.34
10	1650	1656	38.70	50.31	44.51	− 1 30.21	+1.41	−0.03	15.68
8	1675	1682	46 11 52.24	28 12 19.63	37 12 05.93	+ 1 09.62	+0.42	+0.02	15.99
9	1675	1682	52.39	19.71	06.05	+ 1 09.54	+1.05	+0.02	16.66
10	1675	1682	52.52	19.76	06.14	+ 1 09.37	+0.37	+0.02	15.90
8	1695	1697	52 05 54.56	22 00 39.27	37 03 16.91	+ 9 59.10	+0.21	+0.18	16.40
9	1695	1697	54.73	39.32	17.02	+ 9 57.49	+0.42	+0.18	15.11
10	1695	1697	54.89	39.36	17.12	+ 9 59.34	+0.84	+0.18	17.48
12	1695	1697	55.16	39.36	17.26	+ 9 57.60	+0.94	+0.18	15.98
8	1702	1705	24 30 17.71	49 53 35.85	37 11 56.78	+ 1 16.36	+1.68	+0.02	14.84
9	1702	1705	17.77	36.02	56.90	+ 1 19.19	−0.42	+0.02	15.69
12	1702	1705	17.84	36.43	57.14	+ 1 22.14	−0.79	+0.02	18.51
8	1744	1747	38 02 46.38	36 09 01.89	37 05 54.13	+ 7 19.75	+0.84	+0.12	14.84
10	1744	1747	46.62	02.12	54.37	+ 7 21.12	+0.16	+0.12	15.77
12	1744	1747	46.80	02.28	54.54	+ 7 22.09	−1.99	+0.12	14.76
9	1780	1804	53 29 23.04	20 48 33.20	37 08 58.12	+ 4 20.14	−1.10	+0.08	17.24
8	1788	1803	53 34 19.39	20 37 54.02	37 06 06.70	+ 7 06.39	+1.99	+0.13	15.21
9	1788	1803	19.60	54.08	06.84	+ 7 09.17	−1.15	+0.13	14.99

TABEL I.—*Details of latitude work: Station, North Springfield*—Continued.

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1884.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Nov. 12	1788	1803	53 34 20.16	20 37 54.16	37 06 07.16	+ 7 07.31	+1.57	+0.13	37 13 16.17
10	1789	1803	53 32 15.88	20 37 54.12	37 05 05.00	+ 8 10.31	−0.05	+0.13	15.39
8	1808	1825	24 00 01.54	50 20 35.40	37 10 18.47	+ 2 58.29	−0.10	+0.05	16.71
9	1808	1825	01.63	35.62	18.62	+ 3 02.48	−4.40	+0.05	16.75
10	1808	1825	01.69	35.80	18.74	+ 2 58.04	−0.31	+0.05	16.52
9	1837	1845	48 03 25.92	26 22 43.77	37 13 04.84	+ 0 10.66	−1.21	0.00	14.29
10	1837	1845	26.11	43.86	04.98	+ 0 10.26	+0.05	0.00	15.29
12	1837	1841	48 03 26.43	26 35 15.23	37 19 20.83	− 6 03.27	+0.16	−0.10	17.62
8	1851	1857	20 37 51.41	53 35 26.20	37 06 38.80	+ 6 36.94	+1.41	+0.12	17.27
9	1851	1857	51.50	26.44	38.97	+ 6 36.23	+1.68	+0.12	17.00
10	1851	1857	51.54	26.55	39.04	+ 6 39.77	−2.25	+0.12	16.68
12	1856	1869	31 11 18.53	43 19 52.62	37 15 35.57	− 2 20 73	+1.83	−0.04	16.63
8	1867	1871	54 21 27.55	20 07 42.72	37 14 35.14	− 1 21.57	+2.52	−0.02	16.07
9	1867	1871	27.81	42.80	35.30	− 1 21.25	+0.84	−0.02	14.87
10	1867	1871	28.03	42.85	35.44	− 1 16.64	−3.30	−0.02	15.48
10	1888	1890	44 43 38.34	29 27 21.87	37 05 30.10	+ 7 47.09	−1.78	+0.13	15.54
12	1888	1890	38.66	22.02	30.34	+ 7 45.79	−1.36	+0.13	14.90
8	1903	1920	28 08 17.55	46 24 54.59	37 16 36.07	− 3 22.88	+0.37	−0.06	13.50
9	1903	1920	17.67	54.80	36.24	− 3 22.35	+1.73	−0.06	15.56
10	1903	1920	17.77	55.01	36.39	− 3 20.70	−0.68	−0.06	14.95
12	1903	1920	17.91	55.36	36.63	− 3 22.15	+1.57	−0.06	15.99
8	1950	1957	39 59 43.88	34 39 58.33	37 19 51.10	− 6 37.19	+2.62	−0.11	16.42
9	1950	1957	44.08	58.50	51.29	− 6 36.31	+2.31	−0.11	17.18
12	1950	1957	44.54	58.87	51.71	− 6 32.46	−2.36	−0.11	16.78
8	1976	1990	54 34 45.31	20 14 46.04	37 24 45.67	−11 27.57	−0.05	−0.20	17.85
9	1976	1990	45.54	46.13	45.83	−11 29.14	0.00	−0.20	16.49
12	1976	1990	46.08	46.24	46.16	−11 28.05	−1.62	−0.20	16.29
8	2003	2007	20 30 01.01	53 55 56.91	37 12 58.96	+ 0 18.09	−1.94	0.00	16.11
9	2003	2007	01.10	57.10	59.10	+ 0 17.97	+0.94	0.00	18.01
12	2003	2007	01.23	57.60	59.41	+ 0 16.44	+0.42	0.00	16.27
8	2009	2010	32 43 47.50	41 46 40.95	37 15 14.22	− 1 57.23	−0.52	−0.03	16.44
12	2009	2010	48.01	41.66	14.83	− 1 59.93	+0.63	−0.03	15.50

TABLE I.—*Details of latitude work: Station, Bolivar.*

Date.	Star numbers.	δ_1	δ_2*	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
					Micrometer.	Level.		
1884.		° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
Dec. 3	1386 1410	29 38 37.66	46 03 03.19	37 50 50.42	−14 14.68	−1.00	−0.24	37 36 34.50
3	1431 1446	24 47 15.70	50 15 38.70	37 31 27.20	+ 5 07.71	−1.05	+0.09	33.95
3	1500 1502	19 38 28.03	56 02 08.69	37 50 18.36	−13 44.31	+1.78	−0.25	35.58
3	1623 1633	43 29 33.81	31 54 09.73	37 41 51.77	− 5 16.47	+0.79	−0.09	36.00
3	1640 1652	42 17 00.71	32 51 43.74	37 34 22.22	+ 2 08.57	−0.10	+0.03	30.72
4	1640 1652	00.74	43.76	22.25	+ 2 08.09	+1.99	+0.03	32.36
3	1669 1675	28 43 40.69	46 11 54.34	37 27 47.51	+ 8 48.36	−0.79	+0.15	35.23
1	1683 1702	50 59 16.55	24 30 21.24	37 44 48.89	− 8 09.42	−1.47	−0.15	37.85
3	1683 1702	16.72	21.30	49.01	− 8 10.19	−1.78	−0.15	36.89
3	1707 1716	26 16 59.85	49 14 04.94	37 45 32.39	− 9 03.45	+8.70	−0.16	37.48
1	1723 1743	28 23 23.77	47 18 41.44	37 51 02.60	−14 31.90	+1.68	−0.25	32.13
1	1764 1782	56 00 31.54	19 39 46.25	37 50 08.89	--13 34.45	+1.05	−0.23	35.26
1	1792 1801	26 37 23.99	48 43 33.31	37 40 28.65	− 3 52.19	−0.47	−0.07	35.92
1	1812 1821	51 42 36.67	23 38 36.55	37 40 36.61	− 3 58.32	−2.78	−0.07	35.44
1	1850 1867	20 47 03.57	54 21 31.54	37 34 17.55	+ 2 18.91	−1.73	+0.03	34.76
3	1850 1867	03.62	31.86	17.74	+ 2 19.44	−0.84	+0.03	36.37
Nov. 26	1879 1885	54 32 27.32	20 25 28.10	37 28 57.71	+ 7 36.75	+1.36	+0.14	35.96
Dec. 3	1883 1888	30 48 53.53	44 43 41.36	37 46 17.44	− 9 42.87	+0.26	−0.16	34.67
Nov. 26	1937 1957	40 49 55.83	34 40 00.30	37 44 58.06	− 8 23.56	+1.52	−0.14	35.88
Dec. 3	1937 1957	56.49	00.80	58.64	− 8 19.88	−1.57	−0.14	37.05
1	1955 1962	25 09 56.40	50 06 40.46	37 38 18.43	− 1 44.18	+0.84	−0.03	35.06
2	1955 1962	56.44	40.63	18.53	− 1 46.97	+4.51	−0.03	36.04
7	1955 1962	56.72	41.49	19.10	− 1 44.02	+0.37	−0.03	35.42
Nov. 26	1976 1990	54 34 46.51	20 14 46.60	37 24 46.55	+11 47.03	+1.83	+0.21	35.62
Dec. 1	1976 1990	47.30	46.55	46.92	+11 49.06	−1.52	+0.21	34.67
2	1976 1990	47.50	46.59	47.04	+11 44.21	+3.77	+0.21	35.23
3	1976 1990	47.69	46.62	47.15	+11 48.53	−0.16	+0.21	35.73
7	1983 1996	29 01 10.38	46 32 08.55	37 46 39.46	−10 04.02	+0.52	−0.17	35.79
7	2013 2018	17 41 62.60	57 52 40.70	37 47 21.65	−10 47.35	+0.84	−0.18	34.96
1	(1)	48 44 31.69	26 47 09.06	37 45 50.37	− 9 16.81	+1.57	−0.16	34.97
2	(1)	31.86	09.11	50.48	− 9 20.38	+4.77	−0.16	34.71
3	(1)	32.03	09.16	50.59	− 9 14.24	−1.83	−0.16	34.36
7	(1)	32.67	09.34	51.00	− 9 14.68	−0.26	−0.16	35.90
1	(2)	39 40 32.18	35 27 29.92	37 34 01.05	+ 2 32.96	+1.57	+0.04	35.62
2	(2)	32.31	30.02	01.16	+ 2 31.87	+2.10	+0.04	35.17

[1] θ Persei, 41 Arietis.

[2] ϵ Persei, ξ Persei.

TABLE I.—*Details of latitude work: Station, Albuquerque.*

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$		Correction for refraction.	ϕ
						Micrometer.	Level.		
1885.			° ′ ″	° ′ ″	° ′ ″	′ ″	′	″	° ′ ″
June 25	287	291	19 44 44.94	50 21 46.44	35 03 15.69	+ 1 15.86	−1.05	+0.02	35 04 32.64
25	296	306	22 46 06.06	47 17 37.51	35 01 51.78	+ 2 40.35	+1.41	+0.04	33.58
25	320	327	27 01 09.68	42 52 04.90	34 56 37.28	+ 7 54.88	−0.21	+0.14	32.09
30	320	327	10.25	05.58	37.92	+ 7 54.5[illegible]	−0.89	+0.14	31.69
25	346	348	22 30 12.29	47 44 07 05	35 07 09.67	− 2 39.75	+1.94	−0.04	31.82
30	346	348	12.88	07.83	10.35	− 2 37.36	−1.78	−0.04	31.17
25	378	388	30 02 10.73	39 59 44.77	35 00 57.75	+ 3 32.41	+2.88	+0.06	33.10
30	378	388	11.46	45.59	58.52	+ 3 33.54	+0.52	+0.06	32.64
25	399	401	44 24 39.53	25 30 16.95	34 57 28.24	+ 7 02.07	−0.47	[1]+0.12	30.23
25	426	438	50 05 02.92	20 02 37.13	35 03 50.02	+ 0 42.16	+0.21	+0.01	32.40
30	426	438	03.84	37.80	50.82	+ 0 39.41	+3.46	+0.01	33.70
25	456	468	26 25 24.34	43 28 37.66	34 57 01.00	+ 7 32.87	−1.62	+0.13	32.38
July 9	456	468	26.80	40.61	03.70	+ 7 27.55	+0.89	+0.13	32.27
June 30	479	494	33 39 14.86	36 47 13.24	35 13 14.05	− 8 42.62	+0.63	−0.14	31.92
July 9	479	494	16.74	15.22	15.98	− 8 44.35	+1.57	−0.14	33.06
June 25	508	519	23 24 42.74	46 35 28.09	35 00 05.42	+ 4 25.42	+2.57	+0.07	33.48
30	508	519	43.57	29.20	06.38	+ 4 26.96	−0.63	+0.07	32.78
July 5	508	519	44.56	30.44	07.50	+ 4 27.04	−2.57	+0.07	32.04
9	508	519	45.31	31.39	08.35	+ 4 27.97	−4.30	+0.07	32.09
12	508	519	45.70	31.92	08.81	+ 4 24.41	−1.78	+0.07	31.51
June 25	524	527	32 36 18.38	37 39 34.88	35 07 56.63	− 3 24.81	−1.41	−0.06	30.35
July 3	524	527	20.04	36.61	58.32	− 3 26.27	−1.00	−0.06	30.99
5	524	527	20.48	37.11	58.79	− 3 28.73	+3.14	−0.06	33.14
9	524	527	21.35	38.04	59.69	− 3 28.45	+1.78	−0.06	32.96
12	524	527	21.83	38.54	60.18	− 3 26.19	−0.94	−0.06	32.99
June 25	549	568	30 44 37.10	39 08 42.25	34 56 39.67	+ 7 54.52	−3.14	+0.13	31.18
27	549	568	37.53	42.76	40.14	+ 7 49.52	+3.67	+0.13	33.46
July 3	549	568	38.73	44.10	41.41	+ 7 53.15	+1.05	+0.13	35.74
5	549	568	39.20	44.65	41.92	+ 7 54.12	−4.03	+0.13	32.14
9	549	568	40.11	45.64	42.87	+ 7 49.07	+0.84	+0.13	32.91
10	549	568	40.29	45.84	43.06	+ 7 48.83	+1.89	+0.13	33.91
12	549	568	40.58	46.21	43.40	+ 7 49.48	−0.26	+0.13	32.75
3	596	619	25 55 11.96	43 58 22.47	34 56 47.21	+ 7 44.59	+1.62	+0.13	33.55
5	596	619	12.43	23.05	47.74	+ 7 45.51	−0.42	+0.13	32.96
9	596	619	13.33	24.16	48.74	+ 7 45.52	−0.84	+0.13	33.55
12	596	619	13.83	24.81	49.32	+ 7 42.17	+2.10	+0.13	33.72
3	639	641	36 56 34.93	33 13 42.03	35 05 08.48	− 0 38.56	+1.47	[2]−0.01	31.50
5	639	641	35.48	42.57	09.02	− 0 42.08	+4.98	[2]−0.01	32.03
9	639	641	36.56	43.62	10.09	− 0 43.25	+0.42	[2]−0.01	31.37
10	639	641	36.79	43.85	10.32	− 0 42.04	+4.35	−0.01	32.62
12	639	641	37.20	44.23	10.71	− 0 39.33	+1.10	[2]−0.01	32.59
3	643	652	37 24 58.48	32 37 12.08	35 01 05.28	+ 3 21.50	+3.56	+0.05	30.39
6	643	652	59.33	12.90	06.11	+ 3 26.71	0.00	+0.05	32.87
5	646	670	38 56 01.69	31 14 53.32	35 05 27.50	− 1 00.57	+4.40	−0.02	31.31
9	646	670	02.81	54.39	28.60	− 0 55.85	−1.10	−0.02	31.63
12	646	670	03.45	55.01	29.23	− 0 58.68	−1.05	−0.02	29.58
3	683	690	24 22 57.01	46 04 18.59	35 13 37.80	− 9 06.32	−0.05	−0.16	31.27
5	683	690	57.52	19.22	38.37	− 9 07.57	+0.68	−0.16	31.32
6	683	690	57.78	19.53	38.65	− 9 05.91	−2.62	−0.16	29.96
11	689	703	31 16 05.44	38 55 54.74	35 06 00.09	− 1 22.74	−1.78	−0.02	35.55
3	705	710	19 17 46.80	50 48 45.23	35 03 16.01	+ 1 13.74	+2.41	+0.02	32.18

[1] *Reduced to meridian*, +0″.27.

[2] Reduced to meridian, +0″.12.

TABLE I.—*Details of latitude work: Station, Albuquerque*—Continued.

Date.	Star numbers.		δ_1	δ_2	$\frac{1}{2}(\delta_1+\delta_2)$	$\frac{1}{2}(Z_1-Z_2)$ Micrometer.	$\frac{1}{2}(Z_1-Z_2)$ Level.	Correction for refraction.	ϕ
1885.			° ′ ″	° ′ ″	° ′ ″	′ ″	″	″	° ′ ″
July 5	705	710	19 17 47.26	50 48 45.88	35 03 16.57	+ 1 13.49	+1.57	+0.02	35 04 31.65
6	705	710	47.51	46.21	16.86	+ 1 17.05	−1.15	+0.02	32.78
9	705	710	48.21	47.18	17.69	+ 1 17.13	−3.30	+0.02	31.54
10	705	710	48.40	47.47	17.93	+ 1 13.70	+0.10	+0.02	31.75
11	705	710	48.58	47.74	18.16	+ 1 14.67	+0.10	+0.02	32.95
11	711	728	48 25 48.75	21 36 03.30	35 00 56.02	+ 3 36.04	+0.68	+0.06	32.80
3	715	723	40 02 02.63	30 12 11.27	35 07 06.95	− 2 35.18	−0.10	−0.04	31.63
5	715	723	03.24	11.81	07.52	− 2 35.18	−0.26	−0.04	32.04
6	715	723	03.56	12.11	07.83	− 2 34.14	−1.15	−0.04	32.50
9	715	723	04.46	12.94	08.70	− 2 37.61	+2.10	−0.04	33.15
10	715	723	04.73	13.19	08.96	− 2 39.46	+5.14	−0.04	34.60
3	748	753	31 22 51.59	38 44 44.10	35 03 47.84	+ 0 42.44	+2.10	+0.01	32.39
5	748	753	52.16	44.72	48.44	+ 0 44.90	−1.36	+0.01	31.99
6	748	753	52.47	45.04	48.75	+ 0 42.72	+0.47	+0.01	31.95
9	748	753	53.32	45.98	49.65	+ 0 41.43	+0.63	+0.01	31.72
10	748	753	53.59	46.26	49.92	+ 0 40.70	+3.77	+0.01	34.40
11	748	753	53.83	46.52	50.17	+ 0 42.64	−0.89	+0.01	31.93
3	784	793	23 47 38.60	46 07 58.07	34 57 48.33	+ 6 42.37	+2.78	+0.12	33.60
5	784	793	39.13	58.75	48.94	+ 6 43.97	+0.16	+0.12	33.19
6	784	793	39.40	59.10	49.25	+ 6 42.44	+0.63	+0.12	32.44
9	784	793	40.22	08 00.12	50.17	+ 6 36.22	+7.07	+0.12	33.58
10	784	793	40.46	00.44	50.45	+ 6 46.63	−3.35	+0.12	33.85
11	784	793	40.69	00.73	50.71	+ 6 44.63	−3.14	+0.12	32.32
3	811	822	52 05 29.71	18 03 28.34	35 04 29.02	+ 0 01.01	+2.93	0.00	32.96
5	811	822	30.41	28.83	29.62	+ 0 03.55	0.00	0.00	33.17
6	811	822	30.83	29.08	29.95	+ 0 01.62	−0.79	0.00	30.78
9	811	822	31.89	29.85	30.87	+ 0 02.02	+3.83	0.00	32.68
10	811	822	32.17	30.07	31.12	+ 0 03.07	−1.41	0.00	32.78
11	819	832	37 29 22.35	32 41 06.51	35 05 14.43	− 0 40.87	−1.94	[1]−0.01	31.73
3	834	841	33 14 00.51	36 49 55.58	35 01 58.04	+ 2 34.66	−0.42	+0.04	32.32
5	834	841	01.12	56.20	58.66	+ 2 34.14	+0.10	+0.04	32.94
9	834	841	02.39	57.53	59.96	+ 2 32.96	−1.78	+0.04	31.18
10	834	841	02.66	57.83	60.24	+ 2 33.89	−1.31	+0.04	32.86
11	824	841	02.94	58.11	60.52	+ 2 31.67	+1.47	[1]+0.04	33.82
3	873	883	31 34 38.07	38 44 59.62	35 09 48.84	− 5 16.63	−0.47	−0.09	31.65
5	873	883	38.65	45 00.27	49.46	− 5 17.72	+0.84	−0.09	32.49
3	889	896	31 05 44.97	38 57 06.97	35 01 25.97	+ 3 05.51	+0.52	[2]+0.05	32.20
5	889	896	45.35	07.62	26.48	+ 3 05.76	−1.47	[2]+0.05	30.97
9	889	896	46.61	08.97	27.79	+ 3 03.65	+0.05	[2]+0.05	31.69
10	889	896	46.91	09.29	28.10	+ 3 04.14	+0.31	[2]+0.05	32.75
11	889	896	47.17	09.42	28.29	+ 3 03.90	+0.47	+0.05	32.71
3	898	915	21 02 07.96	49 21 34.74	35 11 51.35	− 7 18.70	+0.68	[3]−0.13	33.27
5	898	915	08.48	35.44	51.96	− 7 19.63	−0.84	[3]−0.13	31.43
9	898	915	09.59	36.91	53.25	− 7 22.22	+0.73	[3]−0.13	31.70
11	898	915	10.09	37.59	53.84	− 7 21.13	−0.89	[3]−0.13	31.76
3	938	955	36 05 27.86	34 12 44.62	35 09 06.24	− 4 35.16	+1.26	−0.07	32.27
5	938	955	28.48	45.22	06.85	− 4 33.75	−1.21	−0.07	31.82
9	938	955	29.83	46.55	08.19	− 4 38.02	+5.08	−0.07	35.18
11	928	955	36 13 45.76	34 12 47.16	35 13 16.46	− 8 45.85	+2.10	−0.15	32.56
3	969	1002	36 41 36.02	33 27 49.90	35 04 42.96	− 0 10.30	+0.47	0.00	33.13
5	969	1002	36.67	50.51	43.59	− 0 12.40	+0.26	0.00	31.45
11	969	1002	38.65	52.46	45.55	− 0 13.41	−0.58	0.00	31.56

[1] Reduced to meridian, +0″.12. [2] Reduced to meridian, +0″.15. [3] Reduced to meridian, +0″.07.

(7) *Combination of results for latitudes.*—In order to combine the separate results given in the preceding table so as to obtain the most probable value for the latitude of any station, we must determine the proper weight for the mean of the results for latitude from any one pair of stars. Suppose a pair has been observed on n different nights. Then, if e is the probable error of a single half difference of zenith distances of the stars and e_1 and e_2 the probable errors of their declinations, respectively, the weight of the mean of the results from this pair will be proportional to

$$\frac{1}{\frac{(e_1^2+e_2^2)}{4}+\frac{e^2}{n}}.$$

Values for e_1 and e_2 in this expression are given by Safford in the introduction to his catalogue. They are—

Probable error of declination for star of class AA, 0″.18
Probable error of declination for star of class A, 0 .28
Probable error of declination for star of class B, 0 .43
Probable error of declination for star of class C, 0 7

A value for e was found by the process of comparing the individual results from any pair of stars with their mean. For this process the observations of 1884 furnished 314 measures on 113 pairs, this being the number of pairs, each of which was observed on more than one night. It was found that

$$e=\pm 0''.68.$$

Rounding this value of e and the above values of e_1 and e_2 to the nearest tenth of a second the following table of working weights has been constructed:

Table of weights for latitude results.

No. of nights pair is observed.	Weights for combinations of classes.									
	AA and AA	AA and A	AA and B	AA and C	A and A	A and B	A and C	B and B	B and C	C and C
1	0.98	0.96	0.93	0.80	0.93	0.90	0.79	0.88	0.77	0.68
2	1.89	1.80	1.69	1.32	1.72	1.63	1.28	1.54	1.23	1.02
3	2.72	2.55	2.34	1.69	2.40	2.21	1.62	2.05	1.53	1.22
4	3.51	3.23	2.90	1.96	2.99	2.70	1.87	2.47	1.75	1.36
5	4.24	3.83	3.38	2.17	3.50	3.12	2.06	2.81	1.92	1.46
6	4.93	4.39	3.80	2.34	3.95	3.47	2.21	3.10	2.05	1.53
7	5.56	4.89	4.17	2.47	4.35	3.77	2.33	3.33	2.15	1.59

With the above weights the adopted values for the latitudes of the several stations have been derived. The individual and mean results for each pair and the weights for the means are collected in Table II.

TABLE II.—*Results for latitude: Station, Oswego, Kans.*

Star numbers and class.		Individual results.				Mean.	Weight.
		Aug. 27.	Aug. 28.	Sept. 3.	Sept. 4.		
		° ′ ″	″	″	″	″	
672A	690A	37 09	....	59.50	59.29	59.44	1.8
701AA	714C	....	....	58.68	58.69	58.68	1.3
721A	726C	....	....	59.54	60.59	60.06	1.3
732C	739A	....	....	....	57.47	57.47	0.8
761A	773B	59.34	....	58.96	59.61	59.30	2.2
834AA	838C	58.63	59.62	58.91	60.81	59.49	2.0
848C	858C	57.85	61.01	....	61.27	60.04	1.2
877B	885B	57.36	....	....	58.38	57.87	1.5
927B	940C	61.08	60.87	61.01	....	60.99	1.5
974C	977A	59.85	59.81	61.17	60.63	60.36	1.9
996C	1002A	59.44	57.79	59.26	61.06	59.39	1.9
1013A	1040A	58.80	....	60.27	58.63	59.23	2.5
1038B	1046B	....	60.63	....	....	60.63	0.9
1075A	1096B	61.51	62.88	59.80	59.98	61.04	2.8
1117B	1131A	60.48	58.36	58.20	60.03	59.27	2.8
1144A	1157A	58.98	60.61	61.98	60.45	60.50	3.1
1192A	1202AA	59.79	61.68	....	59.39	60.29	2.6
1212A	1233A	58.92	60.08	59.51	59.87	59.59	3.1
1251A	1267C	....	60.52	59.90	60.70	60.37	1.6
1295B	1306A	....	60.38	58.93	59.67	59.66	2.2
1313A	1336A	....	57.59	....	....	57.59	1.0
1320A	1337C	....	....	59.77	59.80	59.78	1.3
1347C	1370A	....	60.13	....	....	60.13	0.8
1360B	1373A	....	....	60.88	....	60.88	0.9
1380A	1397AA	....	58.89	60.48	59.89	59.75	2.6
1410C	1424A	....	58.88	60.79	60.93	60.20	1.6
1461A	1465B	....	59.80	58.22	60.23	59.42	2.2
1512B	1535B	....	58.92	60.79	60.31	60.01	2.1
1598A	1616A	....	60.27	60.05	....	60.16	1.8
1633B	1640B	....	58.66	60.19	....	59.39	1.5
1675C	1682A	....	59.72	60.75	....	60.23	1.3
1723A	1728C	....	59.42	....	....	59.42	0.8
1798B	1804A	....	60.82	60.99	....	60.90	1.6
1814A	1831A	....	60.53	59.81	....	60.17	1.8

Weighted mean, 37° 09′ 59″.81 ± 0″.09.

TABLE II—Continued.—*Results for latitude: Station, Elk Falls, Kans.*

Star numbers and class.		Individual results.								Mean.	Weight.
		Sept. 21.	Sept. 24.	Sept. 29.	Oct. 1.	Oct. 4.	Oct. 5.	Oct. 7.	Oct. 8.		
		° ′ ″	″	″	″	″	″	″	″	″	
848C	858C	37 22			03.76					03.76	0.7
869C	879B				04.62					04.62	0.7
890B	912AA				02.67					02.67	1.0
957A	970A				03.04					03.04	1.0
977A	987A				04.38					04.38	1.0
996C	1002A				03.87			03.04		03.46	1.3
1013A	1022B				02.51			02.97		02.74	1.6
1038B	1046B				04.27			03.04		03.65	1.5
1123A	1133A							04.51		04.51	1.0
1142C	1168C				04.18					04.18	0.7
1151B	1180A					02.04				02.04	0.9
1192A	1202AA					02.98		04.03		03.50	1.8
1207A	1209A				01.66					01.66	1.0
1211B	1229C					03.14				03.14	0.7
1225B	1235AA				04.03		02.05			03.04	1.7
1251A	1267C				03.77	02.58	03.57			03.31	1.6
1294B	1299AA						03.54			03.54	1.0
1295B	1306A				04.49					04.40	0.9
1302B	1306A					03.73				03.73	0.9
1312A	1332A				03.81					03.81	1.0
1313A	1336A					03.19	03.32			03.25	1.8
1347C	1370A	04.64								04.64	0.8
1371B	1376A		04.05	05.18	04.43	04.74				04.60	2.8
1373A	1390C						03.87			03.87	0.8
1392C	1399B		04.73	05.05	05.23					05.00	1.5
1392C	1402B					03.70				03.70	0.7
1396B	1410C	04.01								04.01	0.7
1420C	1440A	04.66	03.94		02.73					03.78	1.6
1423A	1444A					04.91	03.97		00.90	03.26	2.5
1464C	1480B				03.83					03.83	0.7
1473A	1494B					02.64			03.18	02.91	1.6
1493A	1498B		01.61	04.54	03.97					03.37	2.2
1512B	1535B	04.54	06.49	00.99	04.69	03.03			04.06	03.97	3.1
1559C	1565C	04.44	03.00	05.50	03.04					04.00	1.4
1562A	1575C					02.36			04.68	03.52	1.3
1583A	1602C		03.87	03.36	03.31					03.51	1.6
1598A	1611B					02.63			04.38	03.50	1.6
1609C	1621B		04.55	05.19	04.25					04.66	1.5
1623B	1628A					03.00			03.77	03.39	1.6
1640B	1652A		03.09	04.38	04.34					03.94	2.2
1650A	1656B					02.66			03.24	02.95	1.6
1669A	1675C		04.18	02.66	03.48	04.16			05.14	03.92	2.1

Weighted mean, 37° 22′ 03″.64 ± 0″.07.

Table II—Continued.—*Results for latitude: Station, Fort Scott, Kans.*

Star numbers and class.		Individual results.							Mean.	Weight.
		Oct. 16.	Oct. 24	Oct. 27.	Oct. 28.	Oct. 29.	Oct. 30	Oct. 31.		
		° ′ ″	″	″	″	″	″	″	″	
1060B	1076C	37 50 25.04	......	......	......	......	......	......	25.04	0.7
1170A	1174C	25.35	......	......	25.37	......	......	......	25.36	1.3
1183A	1202AA	25.14	......	25.36	......	......	......	......	25.25	1.8
1203C	1217B	......	......	......	......	26.01	......	......	26.01	0.7
1212A	1223C	26.42	......	25.76	26.84	......	......	......	26.34	1.6
1241A	1251A	23.77	......	......	......	......	......	......	23.77	1.0
1252B	1257C	......	......	......	28.29	26.40	......	......	27.34	1.2
1259A	1264C	23.81	......	......	......	......	......	24.70	24.25	1.3
1261A	1274A	......	......	......	24.44	25.78	......	......	25.11	1.8
1270AA	1286A	26.20	......	......	......	......	......	......	26.20	1.0
1270AA 1271A	} 1286A	......	......	27.36	......	......	......	26.48	26.92	2.3
1296A	1314B	25.05	......	25.51	......	......	......	24.84	25.13	2.2
1302B	1312A	......	......	......	25.75	......	......	......	25.75	0.9
1320A	1326C	25.91	......	25.13	26.07	......	......	25.67	25.69	1.9
1339A	1350A	25.68	25.38	26.42	......	......	......	25.49	25.74	3.1
1359A	1370A	......	27.43	22.16	......	......	24.89	25.40	24.97	3.1
1359A	1372A	25.35	......	......	......	......	......	......	25.35	1.0
1386A	1410C	......	......	25.70	......	......	......	25.08	25.39	1.3
1424A	1438C	27.34	......	25.34	......	......	24.99	25.97	25.91	1.9
1450B	1464C	......	......	......	28.46	......	26.41	......	27.43	1.2
1460A	1464C	......	......	26.08	......	......	......	27.58	26.83	1.3
1493A	1514B	......	......	......	27.55	......	......	......	27.55	0.9
1500A	1502B	......	......	24.77	......	......	......	24.57	24.67	1.6
1534C	1541A	24.83	......	......	......	......	......	......	24.83	0.8
1535B	1539B	......	......	......	27.52	......	......	......	27.52	0.9
1543B	1562A	......	......	......	25.20	......	......	......	25.20	0.9
1558B	1559C	25.30	......	......	......	......	......	25.34	25.32	1.2
1563A	1576A	......	......	25.85	......	......	......	25.87	25.86	1.8
1579A	1598A	26.19	......	26.90	28.27	......	25.69	27.21	26.85	3.5
1604C	1621B	......	......	......	24.47	......	......	......	24.47	0.7
1608A	1619A	25.61	......	......	......	......	......	25.75	25.68	1.8
1636A	1647C	26.37	......	22.23	......	......	......	......	24.35	1.3
1645B	1658A	......	......	......	25.91	......	25.73	......	25.82	1.6
1668B	1687AA	21.25	......	......	23.70	......	......	......	22.47	1.7
1703C	1707A	25.89	......	......	28.00	......	......	......	26.94	1.3
1718A	1727B	25.20	......	24.56	......	......	......	27.50	25.75	2.2
1723A	1735C	......	......	......	24.74	......	......	......	24.74	0.8
1725AA	1743C	......	......	......	......	......	24.60	......	24.60	0.8
1744A	1752A	27.00	......	26.58	27.70	......	......	30.23	27.88	3.1
1762C	1782A	26.13	......	......	......	......	......	28.82	27.47	1.3
1792C	1801B	25.87	......	......	......	......	......	......	25.87	0.7
1800AA	1814A	......	......	......	25.88	......	......	23.65	24.76	1.8
1815A	1827B	26.37	......	......	......	......	......	......	26.37	0.9
1833B	1853B	......	......	......	25.53	......	......	......	25.53	0.9
1857A	1887B	......	......	......	25.76	......	......	......	25.76	0.9

Weighted mean, 37° 50′ 25″.76±0″.11.

Table II—Continued.—*Results for latitude: Station, North Springfield, Mo.*

Star numbers and class.	Individual results.				Mean.	Weight.
	Nov. 8.	Nov. 9.	Nov. 10.	Nov. 12.		
	° ′ ″	″	″	″	″	
1396B 1410C	37 13 15.68	....	....	....	15.68	0.7
1425C 1454B	13.65	15.48	13.42	....	14.18	1.5
1461A 1465B	17.19	16.05	17.45	....	16.90	2.2
1493A 1498B	15.22	14.78	16.70	....	15.57	2.2
1522B 1528A	....	....	17.64	....	17.64	0.9
1525A 1539B	16.08	16.19	....	....	16.13	1.6
1541A 1546C	16.48	16.65	15.32	....	16.15	1.6
1562A 1575C	15.45	13.47	15.74	....	14.89	1.6
1579A 1583A	15.27	14.55	15.25	....	15.02	2.5
1589B 1598A	14.73	15.49	14.83	....	15.02	2.2
1609C 1621B	16.62	15.64	15.75	....	16.00	1.5
1633B 1640B	16.42	15.35	....	....	15.88	1.5
1636A 1640B	....	....	18.48	....	18.48	0.9
1650A 1656B	16.59	16.34	15.68	....	16.20	2.2
1675C 1682A	15.99	16.66	15.90	....	16.18	1.6
1695C 1697C	16.40	15.11	17.48	15.98	16.24	1.4
1702A 1705C	14.84	15.69	....	18.51	16.35	1.6
1744A 1747A	14.84	....	15.77	14.76	15.12	2.5
1780C 1804A	....	17.24	....	....	17.24	0.8
1788B 1803A	15.21	14.99	....	16.17	15.46	2.2
1789A 1803A	....	....	15.39	....	15.39	1.0
1808A 1825A	16.71	16.75	16.52	....	16.66	2.5
1837A 1845B	....	14.29	15.29	....	14.79	1.6
1837A 1841A	....	....	....	17.62	17.62	1.0
1851B 1857A	17.27	17.00	16.68	....	16.98	2.2
1856A 1869B	....	....	....	16.63	16.63	0.9
1867A 1871B	16.01	14.87	15.48	....	15.47	2.2
1888B 1890A	....	....	15.54	14.90	15.22	1.6
1903A 1920B	13.50	15.56	14.95	15.99	15.00	2.8
1950A 1957A	16.42	17.18	....	16.78	16.79	2.5
1976C 1990AA	17.85	16.49	....	16.29	16.88	1.7
2003B 2007C	16.11	18.01	....	16.27	16.80	1.5
2009B 2010AA	16.44	....	....	15.50	15.97	1.7

Weighted mean, 37° 13′ 15″.96 ± 0″.10.

TABLE II—Continued.—*Results for latitude: Station, Bolivar, Mo.*

Star numbers and class.	Individual results.						Mean.	Weight.
	Nov. 26.	Dec. 1.	Dec. 2.	Dec. 3.	Dec. 4.	Dec. 7.		
	° ′ ″	″	″	″	″	″	″	
1386A 1410C	37 36	....	....	34.50	....	....	34.50	0.8
1431A 1446B	....	....	....	33.95	....	....	33.95	0.9
1500A 1502B	....	....	....	35.58	....	....	35.58	0.9
1623B 1633B	....	....	....	36.00	....	....	36.00	0.9
1640B 1652A	....	....	....	30.72	32.36	....	31.54	1.6
1669A 1675C	....	....	....	35.23	....	....	35.23	0.8
1683B 1702A	....	37.85	....	36.89	....	....	37.37	1.6
1707A 1716C	....	....	....	37.48	....	....	37.48	0.8
1723A 1743C	....	32.13	....	....	....	....	32.13	0.8
1764AA 1782A	....	35.26	....	....	....	....	35.26	1.0
1792C 1801B	....	35.92	....	....	....	....	35.92	0.7
1812C 1821A	....	35.44	....	....	....	....	35.44	0.8
1850C 1867A	....	34.76	....	36.37	....	....	35.56	1.3
1879B 1885B	35.96	....	....	....	....	....	35.96	0.9
1883B 1888B	....	....	....	34.67	....	....	34.67	0.9
1937B 1957A	35.88	....	....	37.05	....	....	36.46	1.6
1955C 1962A	....	35.06	36.04	....	....	35.42	35.51	1.6
1976C 1990AA	35.62	34.67	35.23	35.73	....	....	35.31	2.0
1983A 1996C	....	....	....	....	....	35.79	35.79	0.8
2013A 2018C	....	....	....	....	....	34.96	34.96	0.8
(1)	....	34.97	34.71	34.36	....	35.90	34.98	3.5
(2)	....	35.62	35.17	....	....	....	35.40	1.9

[1] θ Persei AA, 41 Arietis AA.
[2] ε Persei AA, ξ Persei AA.

Weighted mean, 37° 36′ 35″.22±0″.20.

TABLE II—Continued.—*Results for latitude: Station, Albuquerque, N. Mex.*

Star numbers and class.		Individual results.										Mean.	Weight.
		June 25.	June 27.	June 30.	July 3.	July 5.	July 6.	July 9.	July 10.	July 11.	July 12.		
		° ′ ″	″	″	″	″	″	″	″	″	″	″	
257A	291B	35 04 32.64	......	......	......	......	......	......	......	......	......	32.64	0.9
296A	306C	33.58	......	......	......	......	......	......	......	......	......	33.58	0.8
320A	327B	32.09	......	31.60	......	......	......	......	......	......	......	31.89	1.6
346B	348C	31.82	......	31.17	......	......	......	......	......	......	......	31.49	1.2
378A	388C	33.10	......	32.64	......	......	......	......	......	......	......	32.87	1.3
399C	401B	30.23	......	......	......	......	......	......	......	......	......	30.23	0.8
426C	438A	32.40	......	33.70	......	......	......	......	......	......	......	33.05	1.3
456A	468B	32.38	......	......	......	......	......	32.27	......	......	......	32.32	1.6
479A	494A	......	......	31.92	......	......	......	33.06	......	......	......	32.49	1.7
508A	519A	33.48	......	32.78	......	32.04	......	32.09	......	......	31.51	32.38	3.5
524A	527A	30.35	......	......	30.99	33.14	......	32.96	......	......	32 99	32.09	3.5
549A	568A	31.18	33.46	......	35.74	32.14	......	32 91	33.91	......	32.75	33.16	4.4
596A	619B	......	......	......	33.55	32.96	......	33.55	......	......	33.72	33.44	2.7
639A	641A	......	......	......	31.50	32.03	......	31.37	32.62	......	32.59	32.02	3.5
643A	652A	......	......	......	30.39	......	32.87	......	......	......	......	31.63	1.7
646C	670B	......	......	......	......	31.31	......	31.63	......	......	29.58	30.84	1.5
683C	690A	......	......	......	31.27	31.32	29.96	......	......	......	......	30 85	1.6
689A	703C	......	......	......	......	......	......	......	......	35.35	......	35.35	0.8
705B	710B	......	......	......	32.18	31.65	32.78	31.54	31.75	32.95	......	32.14	3.1
711A	728A	......	......	......	......	......	......	......	......	32.80	......	32.80	0.9
715A	723A	......	......	......	31.63	32.04	32.50	33.15	34.60	......	......	32.78	3.5
748A	753A	......	......	......	32.39	31.99	31.95	31.72	34.40	31.93	......	32.40	4.0
784A	793C	......	......	......	33.60	33.19	32.44	33.58	33.85	32.32	......	33.16	2.2
811A	822A	......	......	......	32.96	33.17	30.78	32.68	32.78	......	......	32.47	3.5
819A	832A	......	......	......	......	......	......	......	......	31.73	......	31.73	0.9
834AA	841A	......	......	......	32.32	32.94	......	31.18	32.86	33 82	......	32.62	3.8
873B	883C	......	......	......	31.65	32.49	......	......	......	......	......	32.07	1.2
889A	896A	......	......	......	32.20	30.97	......	31.69	32.75	32.71	......	32.06	3.5
898A	915A	......	......	......	33.27	31.43	......	31.70	......	31.76	......	32.04	3.0
938A	955A	......	......	......	32.27	31.82	......	35.18	......	......	......	33.09	2.4
928A	955A	......	......	......	......	......	......	......	......	32.56	......	32.56	0.9
969A	1002A	......	......	......	33.13	31.45	......	......	......	31.56	......	32.05	2.4

Weighted mean, 35° 04′ 32″.40 ± 0″.09.

(8) *Programme for time determination.*—In the time determinations and clock comparisons for the longitude work the following programme was adhered to as closely as circumstances would permit:

1. Observation of four to six time stars with as many sets of level readings.
2. Reversal of transit.
3. Observation of four to six time stars with as many sets of level readings.
4. Exchange of signals.

5, 6, 7. Repetition of 1, 2, 3.

(9) *Method of reduction.*—In a time determination the essential quantity sought is the clock correction or error of the time piece used at some determinate epoch, and the unessential quantities with which that correction is involved in the function observed are the azimuth and collimation of the transit and the rate of the time piece. It would evidently be desirable, if possible, to so arrange the observations that the coefficients of the azimuth, collimation, and rate in the normal equation for the clock correction would vanish. Although it is usually impossible to thus eliminate the effect of the azimuth, collimation, and rate completely, it is generally possible to make a close approximation thereto. To show this fact analytically, and also exhibit the process of reduction followed in computing the clock corrections, let

Δt=the correction to the time piece at the epoch t_0,
t=the observed time of a star's transit,
α=the star's right ascension,
a=the azimuth of the instrument,
c=the collimation of the instrument,
r=the rate of the time piece,
A=the azimuth factor,
C=the collimation factor,
p=the weight of $(t-\alpha)$,
v=the residual error.

Then the type observation equation is

$$\Delta t+Aa+Cc+(t-t_0)r+t-\alpha=v. \tag{1}$$

The normal equation in Δt is

$$[p]\Delta t+[pA]a+[pC]c+[p(t-t_0)]r+[p(t-\alpha)]=0. \tag{2}$$

To secure the complete elimination of the effect of a, c, and r in this equation we must have

$$[pA]=0,\ [pC]=0, \text{ and } [p(t-t_0)]=0. \tag{3}$$

The last condition can always be satisfied by making[1]

$$t_0=\frac{[pt]}{[p]}. \tag{4}$$

A close approximation to the first two conditions of (3) can be secured by selecting stars suitably situated north and south of the zenith and by reversals. These considerations were followed so far as possible in making up the working programme given above.

When the observations are so arranged that the first two of the conditions (3) are approximately satisfied, the clock correction $\varDelta t$ can be readily derived from (2) without forming the other three normal equations. Thus, divide equation (2) by the coefficient of $\varDelta t$ and put

$$\beta=-\frac{[pA]}{[p]},\ \gamma=-\frac{[pC]}{[p]},\ \text{and } \varDelta t_0=-\frac{[p(t-\alpha)]}{[p]}. \tag{5}$$

Then we have

$$\varDelta t=\varDelta t_0+\beta a+\gamma c. \tag{6}$$

Now, since β and γ are by hypothesis small quantities, we need only approximate values of a and c to enable us to get $\varDelta t_0$ from (6) with the required degree of precision.

In the practical application of this method it has been found advantageous to proceed by the following steps:

1. Form the normal equation (2) in the usual manner and compute t_0 by (4) and the reduced normal (6).
2. Disregarding weights, the mean of the observation equations for clamp west minus the mean of those for clamp east will give an approximate value for the collimation c.
3. The application of this value of c to each observation equation will give a corrected value of $(t-\alpha)$ for each star.
4. An approximation to the value (or values) of the azimuth a will then result by eliminating $\varDelta t$ from one or more pairs of the corrected observation equations reached in step 3. This azimuth may then be applied to correct the values of $(t-\alpha)$ reached in step 3.
5. The approximate values of a and c will now give $\varDelta t$ from (6), and the addition of $\varDelta t$ to the values of $(t-\alpha)$ reached in step 4 will give approximate values for the residuals v.
6. Form $[pv]$. If this sum is not zero within $0^s.01$ or $0^s.02$ a brief inspection will show what changes in a and c will make it zero within those limits.

After one night's work at a station it is usually easy to render a and c small, so that if β and γ, as defined by (5), are likewise small, the correct value of $\varDelta t_0$ may be very readily determined without going through all of the above steps. But the entire process may be carried out and the check sum

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[1] It may be shown that the weight of the value $\varDelta t_0$, corresponding to the epoch defined by (4), is a maximum.

$$[pv]=0$$

satisfied as nearly as need be in less time than would be required to form and solve all the normal equations.

By the above process the value of the clock correction Δt and the epoch t_0 are derived from each of the two time determinations. Calling the corrections $\Delta t'$ and $\Delta t''$, respectively, and the corresponding epochs t_0' and t_0'', the rate of the time piece will be given with sufficient accuracy by the equation

$$r=\frac{\Delta t''-\Delta t'}{t_0''-t_0'}. \tag{7}$$

(10) *Weights.*—The errors to which the observed quantity $(t-\alpha)$ is subject may be divided into four classes, viz:

1. Errors whose effect varies as sec δ, δ being the star's declination.
2. Errors whose effect is independent of the star's declination.
3. Culmination errors not involved in 2.
4. Error in the adopted right ascension of the star.[1]

The errors of the first and second class may differ for the transits over different wires by entirely independent amounts, while those of the third and fourth class are the same for the transit over every wire.

Hence, denoting the probable errors for a single transit over one wire corresponding to these sources by ε_1, ε_2, ε_3, and ε_4, respectively, and supposing the observed time t a mean of the times of transit over n lines, the square of the probable error of $(t-\alpha)$ will be

$$\frac{\varepsilon_1^2}{n}\sec^2\delta+\frac{\varepsilon_2^2}{n}+\varepsilon_3^2+\varepsilon_4^2.$$

If unit weight be assigned to the mean transit of an equatorial star over n threads, the weight p of the mean transit of a star whose declination is δ over N threads will be expressed by

$$p=\frac{\dfrac{\varepsilon_1^2}{n}+\dfrac{\varepsilon_2^2}{n}+\varepsilon_3^2+\varepsilon_4^2}{\dfrac{\varepsilon_1^2}{N}\sec^2\delta+\dfrac{\varepsilon_2^2}{N}+\varepsilon_3^2+\varepsilon_4^2}. \tag{8}$$

The values of ε_1 and ε_2 for the Würdemann transit No. 20 have been given in section (5), (*a*). They are, rounding them to the nearest hundredth,

$$\varepsilon_1=\pm 0^s.05 \text{ and } \varepsilon_2=\pm 0^s.05.$$

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[1] To these might be added the error due to uncertainties in the inclination of the horizontal axis of the transit.

The values of ε_3 and ε_4 can not be sharply defined, but we may safely assume for the present purposes that ε_3 lies between $0^s.03$ and $0^s.06$, and that ε_4 for stars of the Berliner Jahrbuch lies between $0^s.02$ and $0^s.06$.[1]

In computing weights from the above formula we have used

$$\varepsilon_3=\pm 0^s.05 \text{ and } \varepsilon_4=\pm 0^s.03.$$

With these values of ε_1 . . . ε_4 and $n=N=5$, the above formula becomes

$$p=\frac{44}{39+5\sec^2\delta}.$$

This has been used for computing weights to be applied to the transits of 1884, when, as a rule, only five wires were observed. For the transits of 1885, when seven wires were observed, a similar formula, derived from (8), with the above constants and $n=N=7$, has been used.

For the transits observed by Professor Pritchett we have taken

$$\varepsilon_1^2=\frac{(0^s.05)^2}{2},$$

a value somewhat greater than would result from the square of the ratio of the magnifying power of his instrument and that of Würdemann No. 20, viz:

$$\left(\frac{70}{125}\right)^2.$$

For his transits $n=N=7$.

It has been deemed sufficient to use the nearest tenth for the weight computed as explained above. The working weights may be conveniently tabulated in the following form, which is the table of weights used in reducing the transits observed with the Würdemann transit No. 20 in 1884:

δ	p
00° 00′	
	1.
34 14	
	.9
51 15	
	.8
59 43	
	.7
65 20	
. . . .	. . . .

This means, for example, that the transits of all stars whose declinations fall between 51° 15′ and 59° 43′ have a weight 0.8.

(11) *Details of time work.*—The following table, Table III, gives the principal details of the time work at the field stations and at the observ-

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[1] It is here assumed that the probable error of the tabular right ascensions does not vary with the declination, which is probably nearly the case for stars between −20° and +60° of declination.

atory at Saint Louis. The first column of the table gives the names of the stars observed. The second column shows the position of the telescope by defining the position of the clamp. The third column gives the weights. The fourth column gives the azimuth factors A, and the fifth the collimation factors C. The sixth column gives the observed time of transit (mean time of wires) corrected for inclination of horizontal axis and daily aberration. The seventh column gives the residuals resulting from the observation equations on substituting in them the clock correction, azimuth, and collimation.

The right ascensions of the stars observed in 1884 have been taken for the most part from the Berliner Jahrbuch; some, however, whose day places are not given in the Jahrbuch, have been taken from the American Ephemeris. The right ascensions of all stars observed in 1885 were taken from the Jahrbuch.

Following each table, giving the above data for a time determination, are the normal equation for Δt and the reduced normal, or the former divided by the coefficient of Δt. There are also given the adopted values of the azimuth and collimation and the clock correction with its epoch. The values of the azimuth and collimation are called *adopted values*, for the reason that they were obtained in the manner explained above and not from the usual full number of normal equations. They may differ in some cases by a few hundredths from the rigorous least square values, but such differences do not affect the exact determination of the clock correction.

(12) *Personal equation work*—On two nights in August, 1884, before commencing the longitude work in Kansas and Missouri, and on two nights in the following December, after completing that work, observations were made for the relative personal equation of Professor Pritchett and the writer. These observations were all made at Saint Louis with Professor Pritchett's transit. The two observers alternated in observing, each observing a sufficient number of stars to secure a time determination. Both sets of observations were reduced by using the same azimuth and collimation, and the difference of the resulting clock corrections gave a measure of the personal equation. The details of these observations are given in the same tabular form as the other time work, and may be seen on pages 84 to 87.

In the determination of the longitude of Albuquerque, N. Mex., in 1885, observations for personal equation were made at Saint Louis on three nights before the work at Albuquerque was begun and on two nights after it was completed. For this purpose the instruments of the Survey were mounted in a temporary observatory alongside that of Washington University, and each observer used his own apparatus for observing and for exchanging clock signals precisely as in the longitude work. The details of these observations follow those of the other time work at Saint Louis in 1885 (see pages 102 to 111).

TABLE III.—*Details of time work.*

[Oswego, Kans., August 29, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
η Ophiuchi	W.	1.0	+0.83	+1.04	17	04	09.88	+.05
ζ Draconis		.6	−1.17	2.44		08	48.73	+.24
b Ophiuchi		1.0	+ .96	1.10		19	43.96	+.04
ι Herculis		9	− .22	1.44		36	35.50	+.06
μ Herculis		1.0	+ .18	1.13		42	20.00	−.09
ξ Draconis		.8	− .62	1.83		51	54.72	−.06
67 Ophiuchi	W.	1.0	+ .56	+1.00		55	15.97	−.12
109 Herculis	E.	1.0	+0.29	−1.08	18	19	11.18	−.11
b Draconis		.8	− .71	1.93		22	37.26	−.10
110 Herculis		1.0	+ .31	1.07		41	06.35	+.04
γ Lyræ		1.0	+ .10	1.19		55	02.22	+.08
ζ Aquilæ	E.	1.0	+ .41	−1.03	19	00	31.15	+.02

Normal equation, $11.1\Delta t+1.134a_w+0.542a_e+2.580c+31.345=0$

Normal equation, $1 \quad +0.102 \quad +0.049 \quad +0.232 + 2.824=0$

Adopted $a_w=-1^s.09$ $a_e=-1^s.09$ $c=+0^s.25$

Chronometer fast $22^s.72$ at $18^h.02$.

[Oswego, Kans., August 29, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h	*m.*	*s.*	*s.*
ψ Cygni	E.	0.8	−0.42	−1.63	19	53	0[illegible].22	−.03
τ Aquilæ		1.0	+ .51	1.01		58	55.06	+.10
θ Aquilæ		1.0	+ .62	1.00	20	05	45.94	+.05
o¹ Cygni		.9	− .23	1.45		10	24.57	+.08
χ Cephei, pr		.3	−2.95	4.57		13	11.50	+.19
γ Cygni		.9	− .06	1.30		18	29.91	+.04
π Capricorni	E.	1.0	+ .87	−1.06		21	08.15	−.03
θ Cephei	W.	0.7	−0.93	+2.17	20	28	03.15	−.13
β Delphini		1.0	+ .40	1.03		32	32.96	−.01
α Cygni		.9	− .19	1.41		37	54.48	−.05
ε Cygni		1.0	+ .08	1.20		41	57.22	+.03
μ Aquarii		1.0	+ .73	1.01		46	50.71	−.06
ν Cygni		.9	− .08	+1.32		53	16.96	−.02
σ² Ursæ Majoris, S. P.		.6	+2.53	−2.62	21	00	35.81	−.07
α Equulei	W.	1.0	+ .54	+1.00		10	28.14	−.04

Normal equation, $13\Delta t+0.518a_w+2.374a_e-1.580c+36.829=0$

Normal equation, $1 \quad +0.040 \quad +0.182 \quad -0.122 + 2.833=0$

Adopted $a_w=-1^s.10$ $a_e=-1^s.10$ $c=+0^s.05$

Chronometer fast $22^s.58$ at $20^h.49$.

TABLE III.—*Details of time work*—Continued.

[Oswego, Kans., August 30, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. *m.* *s.*	*s.*
ζ Draconis	W.	0.6	−1.17	+2.44	17 08 46.84	+.10
b Ophiuchi		1.0	+ .96	1.09	19 42.13	+.07
ι Herculis		.9	− .22	1.44	36 33.51	−.08
μ Herculis		1.0	+ .18	1.13	42 18.24	+.01
ξ Draconis		.8	− .62	1.83	51 52.94	−.05
67 Ophiuchi	W.	1.0	+ .56	+1.00	55 14.26	+.03
72 Ophiuchi	E.	1.0	+0.47	−1.01	18 02 15.03	−.14
η Serpentis		1.0	+ .65	1.00	15 43.04	− 01
109 Herculis		1.0	+ .29	1.08	19 09.22	+.03
1 Aquilæ		1.0	+ .72	1.01	29 18.49	−.08
110 Herculis		1.0	+ .31	1.07	41 04.29	−.03
γ Lyræ	E.	1.0	+ .10	−1.19	55 00.14	+.10

Normal equation, $11.3\Delta t+0.304a_w+2.540a_e+1.084c+22.923=0$

Normal equation, $1 \quad +0.027 \quad +0.224 \quad +0.096 + 2.028=0$

Adopted $a_w=-1^s.10$ $a_e-1^s.10$ $c+0^s.15$

Chronometer fast $20^s.76$ at $18^h.06$.

[Oswego, Kans., August 30, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. *m.* *s.*	*s.*
ψ Cygni	E.	0.8	−0.42	−1.63	19 53 01.48	+.24
τ Aquilæ		1.0	+ .51	−1.01	58 53.06	+.10
3 Ursæ Majoris, S. P		.6	+2.66	+2.77	20 01 39.79	−.20
θ Aquilæ		1.0	+ .62	−1.00	05 43.92	+.04
o^1 Cygni		.9	− .23	1.45	10 22.41	−.05
γ Cygni		.9	− .06	1.30	18 27.90	+.03
ε Delphini	E.	1.0	+ .45	−1.02	28 04.84	+.05
β Delphini	W.	1.0	+0.40	+1.03	20 32 31.03	+.07
ε Aquarii		1.0	+ .74	1.02	41 48.68	−.04
η Cephei		.7	− .86	2.09	43 19.48	+.22
32 Vulpeculæ		1.0	+ .19	1.13	50 01.19	−.04
ν Cygni		.9	− .08	+1.32	53 14.94	−.04
σ^2 Ursæ Majoris, S. P		.6	+2.53	−2.62	21 00 33.69	−.32
ζ Cygni		1.0	+ .15	+1.15	08 24.14	−.10
τ Cygni	W.	.9	− .01	+1.26	10 33.79	−.07

Normal equation, $13.3\Delta t+2.579a_w+2.315a_e+1.396c+13.026=0$

Normal equation, $1 \quad +0.194 \quad +0.174 \quad +0.105 + 0.979=0$

Adopted $a_w=-1^s.10$ $a_e=-1^s.10$ $c=+0.05$

Chronometer fast $20^s.58$ at $20^h.52$.

TABLE III.—*Details of time work*—Continued.

[Oswego. Kans., August 31, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Draconis	E.	0.6	−1.17	−2.44	17	08	44.86	−.14
b Ophiuchi		1.0	+ .96	1.10		19	39.99	−.11
μ Herculis		1.0	+ .18	1.13		42	16.29	−.04
ξ Draconis		.8	− .62	1.83		51	51.15	−.06
67 Ophiuchi	E.	1.0	+ .56	−1.00		55	12.38	+.08
72 Ophiuchi	W.	1.0	+0.47	+1.01	18	02	13.21	+.06
η Serpentis		1.0	+ .65	1.00		15	41.00	−.02
109 Herculis		1.0	+ .29	1.08		19	07.25	+.06
b Draconis		.8	− .71	1.93		22	33.36	+.12
1 Aquilæ		1.0	+ .72	1.01		29	16.47	−.06
110 Herculis		1.0	+ .31	1.07		41	02.31	+.09
γ Lyræ		1.0	+ .10	1.19		54	58.02	−.03
ζ Aquilæ	W.	1.0	+ .41	+1.03	19	00	27.02	−.01

Normal equation, $12.2\Delta t+0.502a_e+2.382a_w+2.776c+1.432=0$

Normal equation, $1\quad +0.041\quad +0.195\quad +0.227\quad +0.118=0$

Adopted $a_w=-1^s.00$ $a_e=-1^s.00$ $c=-0^s.10$

Chronometer fast $18^s.86$ at $18^h.19$.

[Oswego, Kans., August 31, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
γ Aquilæ	W.	1.0	+0.46	+1.02	19	41	07.00	+.18
ψ Cygni		.8	− .42	1.63		52	59.27	+.15
τ Aquilæ		1.0	+ .51	+1.01		58	51.04	+.08
3 Ursæ Majoris, s. P		.6	+2.66	−2.77	20	01	37.94	+.02
θ Aquilæ		1.0	+ .62	+1.00		05	42.11	−.08
24 Vulpeculæ		1.0	+ .24	1.10		12	11.70	−.08
γ Cygni		.9	− .06	1.30		18	26.15	−.10
π Capricorni	W.	1.0	+ .87	+1.06		21	04.48	−.15
ε Delphini	E.	1.0	+0.45	−1.02	20	28	02.72	+.03
73 Draconis		.4	−2.28	3.75		33	22.13	+.21
α Cygni		.9	− .19	1.41		37	50.49	+.08
ε Cygni		1.0	+ .08	1.20		41	53.18	+.06
μ Aquarii		1.0	+ .73	1.01		46	46.94	−.12
32 Vulpeculæ		1.0	+ .19	1.13		49	59.36	−.08
ν Cygni		.9	− .08	−1.32		53	13.29	−.26
σ^2 Ursæ Majoris, s. P		.6	+2.52	+2.62	21	00	31.82	+.43
ζ Cygni		1.0	+ .15	−1.15		08	22.26	+.03
τ Cygni	E.	.9	− .01	−1.26		10	32.00	−.07

Normal equation, $16.0\Delta t+3.906a_w+1.954a_e-3.027c+1.288=0$

Normal equation, $1\quad +0.244\quad +0.122\quad -0.189\quad +0.080=0$

Adopted $a_w=-1^s.07$ $a_e=-1^s.07$ $c=-0^s.10$

Chronometer fast $18^s.71$ at $20^h.47$.

TABLE III.—*Details of time work*—Continued.

[Oswego, Kans., September 1, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
δ Herculis	W.	1.0	+0.23	+1.10	17	10	35.62	+.09
θ Ophiuchi		1.0	+ .97	1.10		15	14.55	+.06
b Ophiuchi		1.0	+ .96	1.10		19	38.45	−.07
β Draconis		.8	− .43	1.64		28	06.91	+.05
ι Herculis		.9	− .22	1.44		36	30.14	−.05
μ Herculis		1.0	+ .18	1.13		42	14.74	.00
ψ¹ Draconis		.5	−1.88	3.27		44	16.03	+.17
ξ Draconis		.8	− .62	1.83		51	49.65	−.05
67 Ophiuchi	W.	1.0	+ .56	+1.00		55	10.71	+.02
72 Ophiuchi	E.	1.0	+0.47	−1.01	18	02	11.30	+.08
η Serpentis		1.0	+ .65	1.00		15	39.18	+.09
109 Herculis		1.0	+ .29	1.08		19	05.12	−.12
b Draconis		.8	− .71	1.93		22	31.15	+.02
1 Aquilæ		1.0	+ .72	1.01		29	14.53	−.08
110 Herculis		1.0	+ .31	1.07		41	00.27	.00
R Lyræ		.9	− .16	1.39		52	07.61	−.11
γ Lyræ		1.0	+ .10	1.19		54	56.04	−.05
ζ Aquilæ	E.	1.0	+ .41	−1.03	19	00	25.20	+.08

Normal equation, $16.7\Delta t+0.922a_w+2.238a_e+0.952c+5.027=0$

Normal equation, $1 \quad +0.055 \quad +0.134 \quad +0.057 \quad +0.301=0$

Adopted $a_w=-1^s.00 \qquad a_e=-1^s.00 \qquad c=-0^s.06$

Chronometer fast $17^s.11$ at $18^h.06$.

[Oswego, Kans., September 1, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Aquilæ	E.	1.0	+0.48	−1.00	19	45	28.02	+.10
ψ Cygni		.8	− .42	1.63		52	57.50	−.04
τ Aquilæ		1.0	+ .51	−1.01		58	49.33	−.09
3 Ursæ Majoris, S. P		.6	+2.66	+2.77	20	01	36.91	−.41
θ Aquilæ		1.0	+ .62	−1.00		05	40.13	+.04
o¹ Cygni		.9	− .23	1.45		10	18.73	−.01
γ Cygni		.9	− .06	1.30		18	24.19	−.05
π Capricorni	E.	1.0	+ .87	−1.06		21	02.43	+.02
ε Delphini	W.	1.0	+0.45	+1.02	20	28	01.08	−.02
73 Draconis		.4	−2.28	3.75		33	20.94	−.19
ε Aquarii		1.0	+ .74	1.02		41	45.13	−.06
μ Aquarii		1.0	+ .73	1.01		46	45.08	+.04
32 Vulpeculæ		1.0	+ .19	1.13		49	57.60	−.02
ν Cygni		.9	− .08	+1.32		53	11.35	−.03
σ² Ursæ Majoris, S. P		.6	+2.53	−2.62	21	00	29.99	+.35
ζ Cygni		1.0	+ .15	+1.15		08	20.51	+.08
τ Cygni	W.	.9	− .01	+1.26		10	30.03	+.19

Normal equation, $15.0\Delta t+3.479a_e+2.785a_w+1.393c+5.578=0$

Normal equation $1 \quad +0.232 \quad +0.186 \quad +0.093 \quad +0.372=0$

Adopted $a_w=-1^s.09 \qquad a_e=-1^s.09 \qquad c=+0^s.02$

Chronometer fast $16^s.92$ at $20^h.48$.

TABLE III.—*Details of time work*—Continued.

[Oswego, Kans., September 2, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Draconis	E.	0.6	−1.17	−2.44	17	08	41.24	−.12
θ Ophiuchi		1.0	+ .97	1.10		15	12.60	+.11
b Ophiuchi		1.0	+ .96	1.10		19	36.64	+.03
β Draconis		.8	− .43	1.64		28	04.84	+.02
ξ Serpentis		1.0	+ .82	1.04		31	15.79	+.04
ι Herculis		.9	− .22	1.44		36	28.13	+.06
ξ Draconis		.8	− .62	1.83		51	47.18	−.36
67 Ophiuchi		1.0	+ .56	1.00		55	08.59	−.09
72 Ophiuchi	E.	1.0	+ .47	−1.01	18	02	09.29	−.02
η Serpentis	W.	1.0	+0.65	+1.00	18	15	36.82	+.08
109 Herculis		1.0	+ .29	1.08		19	02.69	−.09
b Draconis		.8	− .71	1.93		22	28.40	+.17
1 Aquilæ		1.0	+ .72	1.01		29	12.21	−.05
110 Herculis		1.0	+ .31	1.07		40	57.88	+.06
R Lyræ		.9	− .16	1.39		52	05.18	+.10
γ Lyræ		1.0	+ .10	1.19		54	53.55	.00
ζ Aquilæ	W.	1.0	+ .41	+1.03	19	00	22.71	+.03

Normal equation, $15.8\Delta t+1.768a_e+2.040a_w-1.611c+17.618=0$

Normal equation, $1 \quad +0.112 \quad +0.129 \quad -0.102 + 1.115=0$

Adopted $a_w=-1^s.25$ $a_e=-1^s.25$ $c=+0^s.25$

Chronometer fast $14^s.79$ at $18^h.11$.

[Oswego, Kans., September 2, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Aquarii	W.	1.0	+0.48	+1.00	19	45	26.14	+.08
ψ Cygni		.8	− .42	1.63		52	55.40	+.02
τ Aquilæ		1 0	+ .51	1.01		58	47.21	+.08
θ Aquilæ		1.0	+ .62	1.00	20	05	38.25	+.10
o¹ Cygni		.9	− .23	1.45		10	16.54	−.13
γ Cygni		.9	− .06	1.30		18	22.25	+.16
π Capricorni	W.	1.0	+ .87	+1.06		21	00.52	+.07
ε Delphini	E.	1.0	+0.45	−1.02	20	27	59.17	−.01
73 Draconis		.4	−2.28	3.75		33	18.91	−.09
ε Cygni		1.0	+ .08	1.20		41	49.52	−.15
μ Aquarii		1.0	+ .73	1.01		46	43.25	.00
32 Vulpeculæ		1.0	+ .19	1.13		49	55.66	−.05
ν Cygni		.9	− .08	1.32		53	09.46	−.01
ζ Cygni		1.0	+ .15	1.15	21	08	18.64	−.09
τ Cygni	E.	.9	− .01	−1.26		10	28.38	+.02

Normal equation, $13.8\Delta t+1.883a_w+0.607a_e-1.483c+2.562=0$

Normal equation, $1 \quad +0.136 \quad +0.044 \quad -0.108 \quad +0.186=0$

Adopted $a_w=-1^s.10$ $a_e=-1^s.10$ $c=+0^s.05$

Chronometer fast $14^s.98$ at $20^h.47$.

TABLE III.—*Details of time work*—Continued.

[Elk Falls, Kans., September 25, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
d Sagittarii	W.	1.0	+0.88	+1.06	19	14	42.71	−.05
δ Draconis		.6	−1.31	2.61		16	21.91	+.11
τ Draconis		.4	−2.01	3.45		21	36.87	+.03
δ Aquilæ		1.0	+ .57	1.00		23	30.55	+.05
ι Cygni		.8	− .39	1.61		30	38.11	−.03
κ Aquilæ		1.0	+ .71	1.01		34	30.90	−.09
β Sagittæ		1.0	+ .36	1.05		39	42.10	−.14
δ Cygni	W.	.9	− .18	+1.41		45	12.41	+.02
ε Draconis	E.	0.5	−1.57	−2.92	19	52	25.83	+.08
τ Aquilæ		1.0	+ .51	1.01	20	02	20.47	+.11
θ Aquilæ		1.0	+ .62	1.00		09	11.16	+.21
o¹ Cygni		.9	− .23	1.45		13	51.10	−.09
24 Vulpeculæ		1.0	+ .25	1.11		15	41.40	+.06
γ Cygni		.9	− .06	1.30		21	56.52	−.29
ε Delphini		1.0	+ .45	1.02		31	32.53	+.02
Gr. 3241		.5	−1.86	3.26		34	23.83	−.27
α Delphini		1.0	+ .39	1.04		38	07.23	+.11
η Cephei		.7	− .85	2.09		46	48.81	+.02
32 Vulpeculæ	E.	1.0	+ .19	−1.13		53	29.47	+.01

Normal equation, $16.2\Delta t+0.456a_w-0.161a_e-3.715c+19.705=0$

Normal equation, $1 \quad +0.028 \quad -0.010 \quad -0.230 + 1.216=0$

Adopted $a_w=+0^s\ 37 \qquad a_e=+0^s.37 \qquad c=+0^s.17$

Chronometer fast $3^m\ 49^s.18$ at $20^h.06$.

[Elk Falls, Kans., September 25, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
π² Cygni	E.	0.9	−0.30	−1.52	21	46	24.00	−.15
79 Draconis		.4	−2.02	3.45		55	21.20	+.24
ζ Cephei		.8	− .65	1.87	22	10	43.91	+.03
θ Aquarii		1.0	+ .72	1.01		14	35.22	+.13
γ Aquarii	E.	1.0	+ .63	−1.00		19	32.53	−.01
3 Lacertæ	W.	0.8	−0.40	+1.61	22	22	53.20	−.32
σ Aquarii		1.0	+ .77	1.02		28	22.87	−.14
226 Cephei		.4	−2.50	4.03		34	10.05	+.19
η Pegasi		1.0	+ .16	1.15		41	26.62	.00
λ Pegasi	W.	1.0	+ .27	+1.09		44	29.23	+.03

Normal equation, $8.3\Delta t-0.248a_e-0.120a_w-0.094c+8.956=0$

Normal equation, $1 \quad -0.030 \quad -0.014 \quad -0.001 \ +1.079=0$

Adopted $a_w=+0^s.21 \qquad a_e=+0^s.36 \qquad c=+0^s.21$

Chronometer fast $3^m\ 49^s.06$ at $22^h.36$

TABLE III.—*Details of time work*—Continued.

[Elk Falls, Kans., September 28, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s*
ι Cygni	E.	0.8	−0.39	−1.61	19	30	33.56	+.02
κ Aquilæ		1.0	+ .71	1.01		34	26.49	+.03
θ Cygni		.9	− .34	1.56		37	06.55	−.04
β Sagittæ		1.0	+ .36	1.05		39	37.57	+.03
α Aquilæ		1.0	+ .49	1.00		48	54.73	−.04
ε Draconis		.5	−1.57	2.92		52	20.07	−.10
γ Sagittæ		1.0	+ .33	1.06		57	23.16	−.03
τ Aquilæ		1.0	+ .51	1.01	20	02	15.77	−.09
θ Aquilæ		1.0	+ .62	1.00		09	06.70	+.03
o¹ Cygni	E.	.9	− .23	−1.45		13	45.99	−.02
γ Cygni	W.	0.9	−0.06	+1.30	20	21	51.59	+.02
ε Delphini		1.0	+ .45	1.02		31	28.10	+.08
Gr. 3241		.5	−1.86	3.26		34	18.38	+.04
α Delphini		1.0	+ .39	1.04		38	02.83	+.05
η Cephei		.7	− .85	2.09		46	43.88	−.06
μ Aquarii		1.0	+ .74	1.01		50	11.85	−.07
76 Draconis	W.	.2	−5.12	+7.28		54	45.95	.00

Normal equation, $14.4\Delta t+1.410a_e-1.023a_w-2.798c+9.596=0$

Normal equation, $1 \quad +0.098 \quad -0.071 \quad -0.195 +0.666=0$

Adopted $a_w=+0^s.20$ $a_e=+0^s.20$ $c=-0^s.10$

Chronometer fast $3^m\ 44^s.69$ at $20^h.13$.

[Elk Falls, Kans., September 28, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
1 Pegasi	W.	1.0	+0.33	+1.06	21	20	31.37	−.01
β Cephei, pr		.5	−1.58	2.93		30	59.08	−.06
ε Pegasi		1.0	+ .48	1.01		42	17.58	+.05
11 Cephei		.5	−1.67	3.04		44	03.11	−.09
π² Cygni		.9	− .30	1.52		46	19.12	−.03
79 Draconis		.4	−2.02	3.45		55	15.80	−.14
α Aquarii	W.	1.0	+ .62	+1.00	22	03	37.89	+.04
ζ Cephei	E.	0.8	−0.65	−1.87	22	10	38.63	+.09
8 Lacertæ		.8	− .40	1.61		22	48.61	−.01
σ Aquarii		1.0	+ .77	1.02		28	18.47	−.02
α Lacertæ		.9	− .33	1.55		30	19.58	+.09
10 Lacertæ		.9	− .02	1.28		37	51.93	+.04
η Pegasi		1.0	+ .16	1.15		41	22.23	−.02
λ Pegasi	E.	1.0	+ .27	−1.09		44	44.94	+.01

Normal equation, $11.7\Delta t-1.273a_w+0.045a_e+0.212c+7.349=0$

Normal equation, $1 \quad -0.109 \quad +0.004 \quad +0.018 +0.628=0$

Adopted $a_w=0^s.00$ $a_e=0^s.00$ $c=-0^s.15$

Chronometer fast $3^m\ 44^s.62$ at $22^h.16$.

TABLE III—*Details of time work*—Continued.

[Elk Falls, Kans., October 2, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
δ Aquilæ	W.	1.0	+0.57	+1.00	19	23	19.29	+.17
o¹ Cygni		.9	− .23	1.45	20	13	38.89	−.01
π Capricorni		1.0	+ .87	1.06		24	21.49	−.05
61¹ Cygni		.9	− .02	1.27	21	05	22 98	+.17
ν Aquarii		1.0	+ .77	1.02		06	57 26	+.01
Br. 2777		.3	−3.02	4.68		11	29.61	−.82
α Equulei	W.	1.0	+ .54	+1.00		13	42.15	−.05
α Cephei	E.	0.7	−0.89	−2.14	21	19	30.04	+.03
ζ Capricorni		1.0	+ .94	1.09		23	43.49	+.01
β Cephei, pr		.5	−1.58	2.93		30	51.78	+.01
ε Pegasi		1.0	+ .48	1.01		42	10.21	+.04
11 Cephei	E.	.5	−1.67	−3.04		43	55.78	−.05

Normal equation, $9.8\Delta t+1.619a_w-0.828a_e+1.349c+5.250=0$

Normal equation, $1 \quad +0.165 \quad -0.085 \quad +0.138 \quad +0.536=0$

Adopted $a_w=+0^s.20$ $a_e=+0^s.20$ $c=0^s.00$

Chronometer fast $3^m\ 37^s.55$ at $20^h.95$.

[Elk Falls, Kans., October 2, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
γ Aquarii	E.	1.0	+0.63	−1.00	22	19	20.69	+.06
3 Lacertæ		.8	− .40	1.61		22	41.34	−.08
σ Aquarii		1.0	+ .77	1.02		28	11.33	+.16
α Lacertæ		.9	− .33	1.55		30	12.17	−.13
10 Lacertæ	E.	.9	− .02	−1.28		37	44.78	+.12
λ Pegasi	W.	1.0	+0.27	+1.09	22	44	37.86	−.03
ι Cephei		.6	−1.14	2.42		49	16.54	+.11
δ Aquarii		1.0	+ .84	1.04		52	10.47	−.13
o Androm		.9	− .10	1.34	23	00	16.90	+.02
α Pegasi		1.0	+ .40	1.03		02	40.07	−.10
π Cephei	W.	.4	−2.31	+3.81		07	58.58	+.08

Normal equation, $9.5\Delta t+0.765a_e-0.188a_w+1.487c+3.588=0$

Normal equation, $1 \quad +0.081 \quad -0.021 \quad +0.157 \quad +0.378=0$

dopted $a_w=+0^s.10$ $a_e=+0^s.10$ $c=-0^s.10$

Chronometer fast $3^m\ 37^s.37$ at $22^h.70$.

TABLE III.—*Details of time work*—Continued.

[Elk Falls, Kans., October 6, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
δ Aquilæ	W.	1.0	+0.57	+1.00	19	23	09.86	+.01
ι Cygni		.8	− .39	1.61		30	17.17	−.02
κ Aquilæ		1.0	+ .71	1.01		34	10.05	−.03
θ Cygni		.9	− .34	1.56		36	50.24	+.02
β Sagittæ		1.0	+ .36	1.05		39	21.19	+.02
δ Cygni		.9	− .18	1.41		44	51.60	+.04
α Aquilæ		1.0	+ .49	1.00		48	38.40	.00
ε Draconis		.5	−1.57	2.92		52	04.13	+.30
τ Aquilæ		1.0	+ .51	1.01	20	01	59.65	+.16
θ Aquilæ		1.0	+ .62	1.00		08	50.33	+.01
o^1 Cygni	W.	.9	− .23	+1.45		13	29.74	+.1
γ Cygni	E.	0.9	−0.06	−1.30	20	21	34.73	+.03
ε Delphini		1.0	+ .45	1.02		31	11.23	−.02
Gr. 3241		.5	−1.86	3.26		34	00.91	+.18
α Delphini		1.0	+ .39	1.04		37	45.95	−.07
η Cephei		.7	− .85	2.09		46	26.74	−.03
μ Aquarii		1.0	+ .74	1.01		49	54.89	−.16
76 Draconis		.2	−5.12	7.28		54	27.25	+.33
ν Aquarii		1.0	+ .77	1.02	21	06	47.57	−.22
Br. 2777		.3	−3.02	4.67		11	20.52	+.14
α Equulei	E.	1.0	+ .54	−1.00		13	32.59	−.15

Normal equation, $17.6\Delta t+1.488a_w-0.619a_e+0.586c+4.510=0$

Normal equation, $1 \quad +0.084 \quad -0.035 \quad +0.033 +0.256=0$

Adopted $a_w=+0^s.20 \qquad a_e=+0^s.20 \qquad c=-0^s.10$

Chronometer fast 3^m $28^s.26$ at $20^h.21$.

[Elk Falls, Kans., October 6, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Cephei	E.	0.8	−0.65	−1.87	22	10	22.13	+.01
γ Aquarii		1.0	+ .63	1.00		19	11.18	−.13
3 Lacertæ		.8	− .40	1.61		22	32.14	−.04
σ Aquarii		1.0	+ .77	1.02		28	01.80	−.04
α Lacertæ		.9	− .83	1.55		30	03.11	+.04
η Aquarii	E.	1.0	+ .62	−1.00		32	55.30	+.09
10 Lacertæ	W.	0.9	−0.02	+1.28	22	37	35.82	+.17
η Pegasi		1.0	+ .16	1.15		41	05.92	−.07
ι Cephei		.6	−1.14	2.42		49	07.44	+.19
δ Aquarii		1.0	+ .84	1.04		52	01.27	.00
o Androm		.9	− .10	1.34	23	00	07.51	−.13
α Pegasi	W.	1.0	+ .40	+1.03		02	30.88	−.01

Normal equation, $10.9\Delta t+0.883a_e+0.608a_w-0.169c+1.327=0$

Normal equation, $1 \quad +0.081 \quad +0.056 \quad -0.016 +0.122=0$

Adopted $a_w=+0^s.20 \qquad a_e=0^s.20 \qquad c=-0^s.10$

Chronometer fast 3^m $28^s.15$ at $22^h.62$.

TABLE III.—*Details of time work*—Continued.

[Fort Scott, Kans., October 17, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
θ Aquilæ	W.	1.0	+0.63	+1.00	20	02	26.11	-.06
o′ Cygni		.9	- .22	1.45		07	07.67	--.04
κ Cephei, P. R		.3	-2.91	4.57		10	01.53	-.35
γ Cygni		.9	- .05	1.30		15	12.67	-.03
π Capricorni		1.0	+ .89	1.06		17	47.33	-.06
ε Delphini		1.0	+ .46	1.02		24	47.75	-.05
Gr. 3241	W.	.5	-1.84	+3.26		27	43.67	+.24
α Cygni	E.	0.9	-0.17	-1.41	20	34	37.86	+.08
ε Cygni		1.0	+ .09	1.20		38	39.56	-.02
η Cephei		.7	- .83	2.09		40	06.72	+.05
μ Aquarii		1.0	+ .74	1.01		43	30.65	-.08
ν Cygni		.9	- .07	1.32		49	59.96	-.01
ν Aquarii		1.0	+ .78	1.02	21	00	23.35	-.04
ζ Cygni		1.0	+ .16	1.15		05	08.55	+.05
α Cephei		.7	- .88	2.14		13	00.43	.00
ε Pegasi		1.0	+ .48	1.01		35	37.17	-.03
π² Cygni		.9	- .29	1.52		39	40.96	+.12
16 Pegasi	E.	1.0	+ .24	-1.11		44	55.83	+.10

Normal equation, $15.7\Delta t+0.816a_w-0.056a_e-4.730c-62.963=0$

Normal equation, $1 \quad +0.052 \quad -0.004 \quad -0.301 - 4.010=0$

Adopted $a_w=+3^s.00$ $a_e=+3^s.00$ $c=-0^s.03$

Chronometer slow 2^m $53^s.86$ at $20^h.78$.

[Fort Scott, Kans., October 17, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
ι Cephei	E.	0.6	-1.13	-2.42	22	42	48.23	-.51
α Pis. Aus		1.0	+1.07	1.16		48	20.53	+.17
o Androm		.9	- .09	1.34		53	45.64	-.15
α Pegasi		1.0	+ .41	1.03		56	07.34	+.08
π Cephei		.4	-2.29	3.81	23	01	32.93	-.08
φ Aquarii	E.	1.0	+ .71	-1.01		05	26.38	-.01
o Cephei	W.	0.6	-1.29	+2.61	23	11	07.80	+.14
κ Piscium		1.0	+ .60	1.00		18	07.07	-.07
70 Pegasi		1.0	+ .44	1.02		20	25.73	+.02
λ Androm		.9	- .20	1.44		29	04.50	+.05
ι Piscium		1.0	+ .54	1.00		31	07.05	+.12
41 H. Cephei	W.	.6	--1.26	+2.58		39	38.40	+.08

Normal equation, $10\Delta t+0.515a_e-0.130a_w+0.048c-41.069=0$

Normal equation, $1 \quad +0.052 \quad -0.013 \quad +0.005 - 4.107=0$

Adopted $a_w=+3^s.00$ $a_e=+3^s.00$ $c=0.00$

Chronometer slow 2^m $53^s.99$ at $23^h.16$.

TABLE III.—*Details of time work*—Continued.

[Fort Scott, Kans., October 18, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
θ Aquilæ	E.	1.0	+0.63	−1.00	20	02	25.97	+.07
o^1 Cygni		.9	− .22	1.45		07	04.63	+.02
κ Cephei, pr		.3	−2.91	4.57		09	49.81	+.06
γ Cygni		.9	− .05	1.30		15	10.17	+.09
π Capricorni		1.0	+ .88	1.06		17	48.03	+.06
ε Delphini		1.0	+ .46	1.02		24	47.10	+.13
Gr. 3241		.5	−1.84	3.26		27	35.10	+.23
α Delphini		1.0	+ .39	1.04		31	21.63	−.06
α Cygni	E.	.9	− .17	−1.41		34	34.88	−.06
ε Cygni	W.	1.0	+0.09	+1.20	20	38	37.61	+.01
η Cephei		.7	− .83	2.09		40	01.67	+.02
μ Aquarii		1.0	+ .74	1.01		43	30.87	−.02
76 Draconis		.2	−5.08	7.28		47	59.12	+.15
ν Aquarii		1.0	+ .78	1.02	21	00	23.66	−.01
ζ Cygni		1.0	+ .16	1.15		05	06.64	−.10
α Cephei		.7	− .88	2.14		12	55.38	+.13
β Aquarii		1.0	+ .70	1.01		22	34.18	−.15
β Cephei, pr		.5	−1.56	2.93		24	16.39	−.04
ε Pegasi		1.0	+ .48	1.01		35	36.38	−.11
π^2 Cygni	W.	.9	− .29	+1.52		39	37.57	−.05

Normal equation, $16.5\Delta t-0.304a_e+0.171a_w+2.785c-19.112=0$

Normal equation, $1\quad -0.018\quad +0.011\quad +0.169-1.158=0$

Adopted $a_w=-0^s.30$ $a_e=-0^s.30$ $c=0^s.00$

Chronometer slow $2^m\ 56^s.16$ at $20^h.75$.

[Fort Scott, Kans., October 18, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
σ Aquarii	W.	1.0	+0.77	+1.02	22	21	37.90	−.02
α Lacertæ		.9	− .32	1.55		23	38.49	−.15
η Aquarii		1.0	+ .62	1.00		26	31.21	.00
λ Pegasi		1.0	+ .28	1.08		38	04.22	−.08
ι Cephei		.6	−1.13	2.42		42	42.23	+.13
α Pis. Aus		1.0	+1.07	1.16		48	23.02	−.08
o Androm	W.	.9	− .09	+1.34		53	43.16	+.06
π Cephei	E.	0.4	−2.29	−3.81	23	01	22.46	+.32
φ Aquarii		1.0	+ .71	1.01		05	26.16	.00
o Cephei		.6	−1.29	2.61		11	00.73	−.07
κ Piscium		1.0	+ .60	1.00		18	06.43	.00
70 Pegasi		1.0	+ .44	1.02		20	24.73	+.08
λ Androm		.9	− .20	1.44		29	01.31	+.06
ι Piscium	E.	1.0	+ .54	−1.00		31	06.36	−.04

Normal equation, $12.3\Delta t+1.693a_w+0.420a_e-0.103c-15.714=0$

Normal equation, $1\quad +0.138\quad +0.034\quad -0.008-1.277=0$

Adopted $a_w=-0^s.30$ $a_e=-0^s.30$ $c=-0^s.20$

Chronometer slow $2^m\ 56^s.33$ at $22^h.94$.

TABLE III.—*Details of time work*—Continued.

[Fort Scott, Kans., October 19, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
κ Cephei, pr	W.	0.3	−2.91	+4.57	20	09	48.24	.00
π Capricorni		1.0	+ .88	1.06		17	45.89	−.03
θ Cephei		.7	− .91	2.17		24	41.54	−.10
β Delphini		1.0	+ .41	1.03		29	11.11	−.03
α Delphini		1.0	+ .39	1.04		31	19.58	+.02
α Cygni	W.	.9	− .17	+1.41		34	32.73	−.15
η Cephei	E.	0.7	−0.83	−2.09	20	39	58.92	+.05
μ Aquarii		1.0	+ .74	1.01		43	28.51	+.15
ν Cygni		.9	− .07	1.32		49	54.99	+.12
ν Aquarii		1.0	+ .78	1.02	21	00	21.18	+.04
ζ Cygni		1.0	+ .16	1.15		05	04.13	−.05
α Cephei		.7	− .88	2.14		12	52.41	−.06
β Aquarii	E.	1.0	+ .70	−1.01		22	31.80	−.01

Normal equation, $11.2\Delta t+1.120a_w+0.017a_e-1.050c-5.091=0$

Normal equation, $1 \quad +0.100 \quad +0.002 \quad -0.094 \quad -0.455=0$

Adopted $a_w=-0^s.30$ $\quad a_e=-0^s.30$ $\quad c=-0^s.20$

Chronometer slow $2^m\ 58^s.47$ at $20^h.75$.

[Fort Scott, Kans., October 19, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
α Lacertæ	E.	0.9	−0.32	−1.55	22	23	35.58	−.04
η Aquarii		1.0	+ .62	1.00		26	28.49	+.08
10 Lacertæ		.9	− .01	1.28		31	08.36	+.16
η Pegasi		1.0	+ .16	1.15		34	38.86	−.01
λ Pegasi		1.0	+ .29	1.08		38	01.44	+.02
ι Cephei	E.	.6	−1.13	−2.42		42	38.66	−.05
α Pis. Aus	W.	1.0	+1.07	+1.16	22	48	19.68	−.02
o Androm		.9	− .09	1.34		53	40.72	+.02
α Pegasi		1.0	+ .41	1.03		56	04.20	−.02
π Cephei		.4	−2.29	3.81	23	01	21.09	−.13
φ Aquarii		1.0	+ .71	1.01		05	24.13	−.04
o Cephei	W.	.6	−1.29	+2.61		10	59.42	.00

Normal equation, $10.3\Delta t+0.419a_e+0.095a_w+0.267c-7.175=0$

Normal equation, $1 \quad +0.041 \quad +0.009 \quad +0.026 \quad -0.697=0$

Adopted $a_w=-0^s.30$ $\quad a_e=-0^s.30$ $\quad c=-0^s.20$

Chronometer slow $2^m\ 58^s.72$ at $22^h.74$.

TABLE III.—*Details of time work*—Continued.

[Fort Scott, Kans., October 22, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ε Delphini	W.	1.0	+0.46	+1.02	20	24	37.59	+.06
73 Draconis		.4	−2.24	3.75		29	56.70	−.01
α Cygni		.9	− .17	1.41		34	25.57	+.09
ε Cygni		1.0	+ .09	1.20		38	28.15	+.06
μ Aquarii		1.0	+ .74	1.01		43	21.35	−.10
76 Draconis	W.	.2	−5.08	+7.28		47	49.39	+.27
ν Aquarii	E.	1.0	+0.78	−1.02	21	00	14.23	+.09
ζ Cygni		1.0	+ .16	1.15		04	57.11	−.08
α Cephei		.7	− .88	2.14		12	45.52	−.03
ζ Capricorni		1.0	+ .95	1.09		17	00.38	−.08
β Aquarii		1.0	+ .70	1.01		22	24.75	−.05
β Cephei		.5	−1.56	2.93		24	06.62	−.03
74 Cygni		.9	− .05	1.30		29	15.43	+.02
ε Pegasi		1.0	+ .48	1.01		35	26.87	−.09
16 Pegasi		1.0	+ .24	1.11		44	44.65	−.03
20 Cephei	E.	.7	− .89	−2.15		50	26.98	+.16

Normal equation, $13.3\Delta t+1.246a_w-0.775a_e-4.573c-7.843=0$

Normal equation, $1 \quad +0.094 \quad -0.058 \quad -0.344 \quad -0.590=0$

Adopted $a_w=-0^s.30$ $a_e=-0^s.30$ $c=-0^s.05$

Chronometer slow 3^m $05^s.58$ at $21^h.11$.

[Fort Scott, Kans., October 22, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
o Androm	E.	0.9	−0.09	−1.34	22	53	33.44	+.16
α Pegasi		1.0	+ .41	1.03		55	56.83	−.01
π Cephei		.4	−2.29	3.81	23	01	13.40	−.03
φ Aquarii		1.0	+ .71	1.01		05	16.72	−.03
o Cephei		.6	−1.29	2.61		10	51.58	−.25
κ Piscium	E.	1.0	+ .60	−1.00		17	57.04	.00
70 Pegasi	W.	1.0	+0.44	+1.02	23	20	15.38	+.10
λ Androm		.9	− .20	1.44		28	52.00	−.02
ι Piscium		1.0	+ .54	1.00		30	57.07	+.05
φ Pegasi		1.0	+ .35	1.05		43	33.43	+.04
Gr. 4163		.4	−2.10	3.58		46	13.82	−.20
33 Piscium		1.0	+ .70	1.01		56	21.89	+.01
β Cassiopeæ	W.	.8	− .68	+1.92		59	59.32	−.04

Normal equation, $11.0\Delta t-0.051a_e+0.466a_w+1.008c-9.034=0$

Normal equation, $1 \quad -0.005 \quad +0.043 \quad +0.092-0.821=0$

Adopted $a_w=-0^s.20$ $a_e=-0^s.20$ $c=0^s.00$

Chronometer slow 3^m $05^s.83$ at $23^h.42$.

TABLE III.—*Details of time work*—Continued.

[Fort Scott, Kans., October 23, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ε Delphini	E.	1.0	+0.46	−1.02	20	24	33.92	−.05
73 Draconis		.4	−2.24	3.75		29	55.18	+.19
α Cygni		.9	− .17	1.41		34	22.42	+.09
ε Cygni		1.0	+ .09	1.20		38	24.64	−.19
μ Aquarii		1.0	+ .74	1.01		43	17.71	+.04
76 Draconis	E.	.2	−5.08	−7.28		47	49.49	+.16
ν Aquarii	W.	1.0	+0.78	+1.02	21	00	10.21	+.02
ζ Cygni		1.0	+ .16	1.15		04	53.70	+.11
α Cephei		.7	− .88	2.14		12	42.61	+.14
ζ Capricorni		1.0	+ .95	1.09		16	56.39	−.02
β Aquarii		1.0	+ .70	1.01		22	20.86	−.05
β Cephei, pr		.5	−1.56	2.93		24	03.92	+.05
11 Cephei		.5	−1.65	3.04		37	07.72	−.20
16 Pegasi	W.	1.0	+ .24	+1.11		44	41.03	−.02

Normal equation, $11.2\Delta t - 0.775a_e + 0.609a_w + 2.408c - 10.861 = 0$

Normal equation, $1 \quad -0.069 \quad +0.054 \quad +0.215 - 0.970 = 0$

Adopted $a_w = +0^s.30 \qquad a_e = +0^s.30 \qquad c = +0^s.15$

Chronometer slow $3^m\ 08^s.94$ at $21^h.02$.

[Fort Scott, Kans., October 23, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
δ Aquarii	W.	1.0	+0.85	+1.04	21	45	23.42	.00
o Androm		.9	− .09	1.34		53	29.95	+.07
α Pegasi		1.0	+ .41	1.03		55	53.19	+.03
π Cephei		.4	−2.29	3.81	23	01	11.08	−.03
φ Aquarii		1.0	+ .71	1.01		05	12.82	−.07
o Cephei	W.	.6	−1.29	+2.61		10	48.75	−.27
κ Piscium	E.	1.0	+0.60	−1.00	23	17	53.56	+.16
70 Pegasi		1.0	+ .44	1.02		20	11.69	−.05
λ Androm		.9	− .20	1.44		28	48.87	−.02
ι Piscium		1.0	+ .54	1.00		30	53.46	+.03
41 H. Cephei		.6	−1.26	2.58		39	20.12	+.02
ω Piscium	E.	1.0	+ .53	−1.01		50	15.76	+.01

Normal equation, $10.4\Delta t + 1.174a_w + 0.199a_e + 0.502c - 2.426 = 0$

Normal equation, $1 \quad +0.113 \quad +0.019 \quad +0.048 - 0.233 = 0$

Adopted $a_w = +0^s.40 \qquad a_e = +0^s.40 \qquad c = +0^s.08$

TABLE III.—*Details of time work*—Continued.

Chronometer slow 3^{m} $09^{s}.18$ at $23^{h}.75$.

[North Springfield, Mo., November 13, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
σ Aquarii	W.	1.0	+0.76	+1.02	22	24	48.95	+.01
α Lacertæ		.9	− .33	1.55		26	49.46	+.06
226 Cephei		.4	−2.50	4.03		30	33.43	−.01
ζ Pegasi		1.0	+ .46	1.02		35	59.25	+.09
λ Pegasi		1.0	+ .27	1.09		41	15.27	−.01
ι Cephei		.6	−1.15	2.42		45	52.54	+.11
δ Aquarii	W.	1.0	+ .84	+1.04		48	48.22	−.02
o Androm	E.	0.9	+0.10	−1.34	21	56	53.78	+.01
α Pegasi		1.0	+ .40	1.03		59	17.43	−.07
π Cephei		.4	−2.32	3.81	22	04	32.84	+.32
φ Aquarii		1.0	+ .70	1.01		08	37.28	−.16
o Cephei		.6	−1.32	2.61		14	11.74	+.05
4 Cassiopeæ	E.	.7	− .87	−2.11		20	00.62	−.15

Normal equation, $10.5\Delta t-1.319a_{w}+0.343a_{e}+0.816c+1.653=0$

Normal equation, $1 \quad -0.126 \quad +0.033 \quad +0.078 \quad +0.157=0$

Adopted $a_{w}=-0^{s}.25$ $a_{e}=-0^{s}.25$ $c=-0^{s}.10$

Chronometer fast $15^{s}.17$ at $22^{h}.82$.

[North Springfield, Mo., November 13, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
φ Pegasi	E.	1.0	+0.34	−1.05	23	46	54.06	+.02
Gr. 4163		.4	−2.13	3.58		49	33.95	+.03
ω Piscium		1.0	+ .52	1.01		53	40.03	+.02
β Cassiopeæ		.8	− .70	1.92	00	03	19.88	+.06
γ Pegasi	E.	1.0	+ .40	−1.03		07	34.65	−.03
ι Ceti	W.	1.0	+0.74	+1.01	00	13	49.86	+.05
44 Piscium		1.0	+ .59	1.00		19	46.36	+.06
ζ Cassiopeæ		.8	− .46	1.67		30	51.23	+.01
δ Androm	W.	1.0	+ .14	+1.16		33	26.96	−.16

Normal equation, $8.0\Delta t+1.102a_{e}-0.152a_{w}-1.552c+0.726=0$

Normal equation, $1 \quad +0.138 \quad -0.019 \quad -0.194 \quad +0.091=0$

Adopted $a_{w}=-0^{s}.15$ $a_{e}=-0^{s}.15$ $c=-0^{s}.05$

Chronometer fast $15^{s}.08$ at $00^{h}.16$.

TABLE III.—*Details of time work*—Continued.

[North Springfield, Mo., November 14, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
σ Aquarii	E.	1.0	+0.76	−1.02	22	24	44.55	+.06
α Lacertæ		.9	− .33	1.55		26	45.49	+.02
226 Cephei		.4	−2.50	4.03		30	30.13	−.14
ζ Pegasi		1.0	+ .46	1.02		35	54.88	−.01
λ Pegasi		1.0	+ .27	1.09		41	11.10	.00
δ Aquarii	E.	1.0	+ .84	−1.04		48	43.74	−.02
o Androm	W.	0.9	−0.10	+1.34	22	56	50.35	+.21
α Pegasi		1.0	+ .40	1.03		59	13.63	+.08
π Cephei		.4	−2.32	3.81	23	04	30.71	+.16
φ Aquarii		1.0	+ .70	1.01		08	33.36	+.03
o Cephei		.6	−1.32	2.61		14	08.54	−.36
4 Cassiopeæ	W.	.7	− .87	+2.11		19	57.51	−.16

Normal equation, $9.9\Delta t+1.033a_e-1.319a_w+0.636c+3.229=0$

Normal equation, $1 \quad +0.105 \quad -0.133 \quad +0.064 \quad +0.326=0$

Adopted $a_w=+0^s.30$ $a_e=+0^s.30$ $c=-0^s.05$

Chronometer fast $11^s.31$ at $22^h.82$.

[North Springfield, Mo., November 14, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
41 H. Cephei	W.	0.6	−1.29	+2.58	23	42	39.79	+.06
φ Pegasi		1.0	+ .34	1.05		46	50.25	+.09
Gr. 4163		.4	−2.13	3.58		49	31.36	−.12
ω Piscium		1.0	+ .52	1.01		53	36.08	+.04
β Cassiopeæ		.8	− .70	1.92	00	03	16.23	−.29
γ Pegasi	W.	1.0	+ .40	+1.03		07	30.66	−.10
ι Ceti	E.	1.0	+0.74	−1.01	00	13	45.47	+.03
44 Piscium		1.0	+ .59	1.00		19	41.97	−.02
12 Ceti		1.0	+ .67	1.00		24	21.71	+.05
ζ Cassiopeæ		.8	− .46	1.67		30	47.32	+.03
δ Androm		1.0	+ .14	1.16		33	22.96	−.03
o Cassiopeæ	E.	.9	− .27	−1.48		38	32.18	+.13

Normal equation, $10.5\Delta t+1.529a_w-0.926a_e+0.768c+1.950=0$

Normal equation, $1 \quad +0.145 \quad -0.088 \quad +0.073 \quad +0.186=0$

Adopted $a_w=+0^s.30$ $a_e=+0^s.30$ $c=-0^s.10$

Chronometer fast $11^s.20$ at $00^h.03$.

TABLE III.—*Details of time work*—Continued.

[North Springfield, Mo., November 15, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ζ Pegasi	W.	1.0	+0.46	+1.02	22	35	51.34	+.02
λ Pegasi		1.0	+ .27	1.09		41	07.55	+.06
α Pis. Aus	W.	1.0	+1.07	+1.16		51	24.90	−.08

Normal equation, $3.6\Delta t + 1.110 a_w + 4.722 c + 2.542 = 0$

Normal equation, $1 \quad +0.308 \quad +1.312 \quad +0.706 = 0$

Adopted $a_w = +0^s.12$ $c = -0^s.02$

Chronometer fast $7^s.61$ at $22^h.71$.

[North Springfield, Mo., November 15, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
δ Sculptoris	E.	1.0	+1.04	−1.14	23	43	03.55	+.03
φ Pegasi		1.0	+ .34	1.05		46	46.31	−.05
Gr. 4163		.4	−2.13	3.58		49	26.73	−.17
ω Piscium		1.0	+ .52	1.01		53	32.26	−.03
β Cassiopeæ		.7	− .70	1.92	00	03	12.48	+.06
22 Androm	E.	.9	− .20	−1.43		04	29.60	−.11
ι Ceti	W.	1.0	+0.74	+1.01	00	13	42.04	+.07
44 Piscium		1.0	+ .59	1.00		19	38.61	+.12
ζ Cassiopeæ		.8	− .46	1.67		30	43.76	+.09
δ Androm		1.0	+ .14	1.16		33	19.46	+.02
ζ Androm	W.	1.0	+ .26	+1.09		41	23.10	.00
γ Cassiopeæ	E.	0.7	−0.78	−2.01	00	49	56.58	−.01
ε Piscium		1.0	+ .50	1.01		57	06.51	−.21
f Piscium		1.0	+ .56	1.00	01	12	00.26	+.03
40 Cassiopeæ	E.	.5	−1.91	−3.32		29	33.44	+.15

Normal equation, $13.0\Delta t + 1.362 a_e - 0.063 a_w - 6.744 c + 5.947 = 0$

Normal equation, $1 \quad +0.105 \quad -0.005 \quad -0.519 \quad +0.457 = 0$

Adopted $a_w = +0^s.12$ $a_e = +0^s.12$ $c = -0^s.02$

Chronometer fast $7^s.48$ at $00^h.39$.

TABLE III.—*Details of time work*—Continued.

[North Springfield, Mo., November 16, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Lacertæ	W.	0.9	−0.33	+1.55	22	26	38.88	+.16
ζ Pegasi		1.0	+ .46	1.02		35	48.60	+.12
λ Pegasi		1.0	+ .27	1.09		41	04.51	−.09
ι Cephei	W.	.6	−1.15	+2.42		45	41.49	− 25
δ Aquarii	E.	1.0	+0.84	−1.04	22	48	37.35	−.02
α Pis. Aus		1.0	+1.07	1.16		51	22.14	.00
o Androm		.9	− .10	1.34		56	43.15	−.01
α Pegasi		1.0	+ .40	1.03		59	06.95	+.09
π Cephei		.4	−2.32	3.81	23	04	22.17	+.09
φ Aquarii	E.	1.0	+ .70	−1.01		08	26.69	−.10

Normal equation, $8.8\Delta t+1.992a_w-0.257a_e-2.013c+5.274=0$

Normal equation, $1 \quad +0.226 \quad -0.029 \quad -0.226 +0.593=0$

Adopted $a_w=-0^s.18$ $a_e=-0^s.18$ $c=-0^s.08$

Chronometer fast $4^s.58$ at $22^h.81$.

[North Springfield, Mo., November 16, 1884. After signals. Observer. Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ι Aquarii	E.	1.0	+0.88	−1.06	23	38	18.53	−.04
41 H. Cephei		.6	−1.29	2.58		42	32.34	−.01
φ Pegasi		1.0	+ .34	1.05		46	43.26	+.04
ω Piscium		1.0	+ .52	1.01		53	29.05	−.08
β Cassiopeæ	E.	.8	− .70	−1.92	00	03	09.35	+.01
γ Pegasi	W.	1.0	+0.40	+1.03	00	07	24.08	+.03
ι Ceti		1.0	+ .74	1.01		13	38.96	+.01
44 Piscium		1.0	+ .59	1.00		19	35.47	−.01
ζ Cassiopeæ		.8	− .46	1.67		30	40.85	−.01
α Cassiopeæ	W.	.8	− .57	+1.78		34	06.20	+.07

Normal equation, $9.0\Delta t+0.906a_e+0.406a_w-0.404c+3.964=0$

Normal equation, $1 \quad +0.101 \quad +0.045 \quad -0.045 +0.440=0$

Adopted $a_w=+0^s.25$ $a_e=+0^s.25$ $c=-0^s.10$

Chronometer fast $4^s.48$ at $00^h.03$.

TABLE III.—*Details of time work*—Continued.

[Bolivar, Mo., December 15, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t	v
					h. m. s.	s.
ν Androm	W.	0.9	−0.07	+1.32	1 28 32.15	.00
τ Ceti		1.0	+ .85	1.04	37 13.55	+.11
ε Cassiopeæ		.7	− .95	2.21	44 36.29	−.24
β Arietis		1.0	+ .32	1.07	46 46.59	−.06
50 Cassiopeæ		.5	−1.81	3.21	52 06.77	+.30
α Arietis	W.	1.0	+ .28	+1.09	59 10.84	−.06
γ Trianguli	E.	1.0	+0.09	−1.20	2 08 58.17	−.01
ι Cassiopeæ		.6	−1.25	2.55	18 04.97	+.03
ξ² Ceti		1.0	+ .50	1.01	20 32.52	+.06
36 Cassiopeæ		.5	−1.87	3.29	25 36.14	−.17
δ Ceti	E.	1.0	+ .61	−1.00	32 05.23	.00

Normal equation, $9.2\Delta t - 0.183a_w - 0.485a_e + 1.155c - 21.653 = 0$

Normal equation, $1 \quad -0.020 \quad -0.053 \quad +0.125 - 2.453 = 0$

Adopted $a_w = -1^s.86$ $\quad a_e = -1^s.86$ $\quad c = +0^s.03$

Chronometer slow $1^m\ 32^s.21$ at $2^h.10$.

[Bolivar, Mo., December 15, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t	v
					h. m. s.	s.
48 H. Cephei	E.	0.3	−2.90	−4.55	3 04 15.25	+.26
ζ Arietis		1.0	+ .31	1.07	06 47.07	+.11
α Persei		.9	− .32	1.54	14 36.07	−.07
f Tauri		1.0	+ .43	1.02	23 01.12	−.08
ε Eridani	E.	1.0	+ .75	−1.02	26 00.77	+.01
γ Camelop	W.	0.5	−1.69	+3.07	3 36 43.28	+.45
η Tauri		1.0	+ .26	1.09	39 08.28	+.01
ζ Persei		1.0	+ .12	1.17	45 23.25	−.24
γ Eridani		1.0	+ .81	1.03	51 09.80	−.10
c Persei	W.	.9	− .25	+1.48	58 47.80	−.16

Normal equation, $8.6\Delta t + 0.332a_e + 0.120a_w + 0.256c - 21.386 = 0$

Normal equation, $1 \quad +0.039 \quad +0.014 \quad +0.035 - 2.487 = 0$

Adopted $a_w = -1^s.86$ $\quad a_e = -1^s.86$ $\quad c = +0^s.07$

Chronometer slow $1^m\ 32^s.58$ at $3^h.53$.

TABLE III.—*Details of time work*—Continued.

[Bolivar, Mo., December 18, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Cassiopeæ	E.	0.8	−0.45	−1.67	00	28	49.99	−.19
δ Androm		1.0	+ .15	1.16		31	24.51	+.11
o Cassiopeæ		.9	− .26	1.48		36	34.80	+.31
δ Piscium		1.0	+ .51	1.01		40	55.18	+.06
γ Cassiopeæ	E.	.7	− .77	−2.01		48	04.18	+ 13
ε Piscium	W.	1.0	+0.51	+1.01	00	55	10.72	−.05
44 Cephei		.2	−3.48	5.27	1	00	53.25	+.04
f Piscium		1.0	+ .57	1.00		10	04.11	−.02
δ Cassiopeæ		.8	− .74	1.98		16	35.88	−.18
η Piscium		1.0	+ .40	1.03		23	32.54	−.15
ν Persei	W.	.9	− .27	+1.50		29	12.21	+.01

Normal equation, $9.3\Delta t-0.473a_e-0.051a_w+0.783c-59.683=0$

Normal equation, $1 \quad -0.051 \quad -0.005 \quad +0.084 - 6.418=0$

Adopted $a_w=+3^s.35$ $\quad a_e=+3^s.25$ $\quad c=-0^s.05$

Chronometer slow $1^m\ 46^s.61$ at $00^h.94$.

[Bolivar, Mo., December 18, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Arietis	W.	1.0	+0.28	+1.09	1	58	54.89	+.31
ξ² Ceti	W.	1.0	+ .50	+1.01	2	20	14.91	−.02
δ Ceti	E.	1.0	+0.61	−1.00	2	31	46.78	−.02
θ Persei		.9	− .29	1.52		34	36.97	+.14
41 Arietis		1.0	+ .21	1.12		41	26.29	−.04
τ Persei	E.	.8	− .41	−1.63		44	24.61	−.47

Normal equation, $5.7\Delta t+0.780a_w+0.231a_e-2.692c-44.282=0$

Normal equation, $1 \quad +0.137 \quad +0.040 \quad -0.473 - 7.769=0$

Adopted $a_w=+3^s.35$ $\quad a_e=+3^s.75$ $\quad c=-0^s.05$

Chronometer slow $1^m\ 47^s.13$ at $2^h.46$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., August 29, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
109 Herculis	E.	1.0	+0.31	−1.08	7	44	58.54	+.03
χ Draconis		.9	−1.88	3.36		49	21.50	−.01
β Lyræ		1.0	+ .11	1.20	8	11	56.89	+.08
θ Serpentis, pr		1.0	+ .57	1.00		16	35.42	+.23
ζ Aquilæ	E.	1.0	+ .43	−1.03		26	11.44	−.06
θ Lyræ	W.	1.0	+0.02	+1.27	8	38	26.56	+.04
τ Draconis		.9	−1.96	3.45		43	54.94	−.13
δ Aquilæ		1.0	+ .58	1.00		45	43.42	−.04
β Cygni		1.0	+ .21	1.13		52	06.20	−.10
β Sagittæ	W.	1.0	+ .38	+1.05	9	01	52.30	−.05

Normal equation, $9.8\Delta t-0.272a_e-0.574a_w+0.221c+20.258=0$

Normal equation, $1 \quad -0.028 \quad -0.059 \quad +0.023+2.067=0$

Adopted $a_w=+1^s.12$ $a_e=+1^s.12$ $c=0^s.47$

Clock fast $49^s.96$ at $8^h.45$.

[Saint Louis, Mo., August 29, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
θ Aquilæ	W.	1.0	+0.64	+1.00	9	31	16.81	+.03
o¹ Cygni, seq		1.0	− .20	1.45		35	56.17	−.04
κ Cephei, pr		.8	−2.87	4.58		38	49.58	+.01
ε Delphini	W.	1.0	+ .47	+1.02		53	38.93	.00
β Delphini	E.	1.0	+0.43	−1.03	9	57	58.73	+.05
α Delphini		1.0	+ .41	1.04	10	00	06.76	−.01
ε Cygni		1.0	+ .11	1.20		07	21.92	−.04
η Cephei	E.	1.0	− .81	−2.09		08	47.43	+.01

Normal equation, $7.8\Delta t-1,386a_w+0.140a_e+1.774c+10.136=0$

Normal equation, $1 \quad -0.178 \quad +0.018 \quad +0.230+1.300=0$

Adopted $a_w=+1^s.17$ $a_e=+1^s.01$ $c=+0^s.47$

Clock fast $50^s.00$ a $9^h.87$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., August 30, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
χ Draconis	E.	.9	−1.88	−3.36	7	45	25.61	+.05
110 Herculis		1.0	+ .33	1.07	8	02	53.92	+.02
β Lyræ		1.0	+ .11	1.20		08	00.82	+.03
θ Serpentis, pr		1.0	+ .57	1.00		12	39.35	.00
ζ Aquilæ	E.	1.0	+ .43	−1.03		32	15.40	+.04
θ Lyræ	W.	1.0	+0.02	+1.27	8	34	29.96	+.01
τ Draconis		.9	−1.96	3 45		39	57.91	.00
δ Aquilæ		1.0	+ .58	1.00		41	46.92	−.05
β Cygni		1.0	+ .21	1.13		48	09.71	−.05
β Sagittæ	W.	1.0	+ .38	+1.05		57	55.84	.00

Normal equation, $9.8\Delta t-0.252a\ -0.574a_w+0.231c+16.446=0$

Normal equation, $1\quad -0.026\quad -0.059\quad +0.024+1.678=0$

Adopted $a_w=+0^s.95$ $\qquad a_e=+1^s.08$ $\qquad c=-0^s.26$

Clock fast $49^s.58$ at $8^h,43$.

[Saint Louis, Mo., August 30, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
θ Aquilæ	W.	1.0	+0.64	+1.00	9	27	19.85	+.06
o¹ Cygni, seq		1.0	− .20	1.45		31	59.52	−.01
κ Cephei, pr		.8	−2.87	4.58		34	51.88	−.01
ε Delphini	W.	1.0	+ .47	+1.02		49	37.36	−.03
β Delphini	E.	1.0	+0.43	−1.03	9	53	02.65	+.03
α Delphini		1.0	+ .41	1.04		56	10.69	−.03
ε Cygni		1.0	+ .11	1.20	10	03	25.92	.00
η Cephei	E.	1.0	− .81	−2.09		04	51.48	.00

Normal equation, $7.8\Delta t-1.386a_w+0.140a_e+1.774c+14.220=0$

Normal equation, $1\quad -0.178\quad +0.018\quad +0.230+1.823=0$

Adopted $a_w=+1^s.08$ $\qquad a_e=+0^s.92$ $\qquad c=-0^s.24$

Clock fast $49^s.59$ at $9^h.80$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., August 31, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	O	t			v
				s	h.	m.	s.	s.
χ Draconis	E.	0.9	−1.88	−3.36	7	41	29.33	.00
110 Herculis		1.0	+ .34	1.07		58	57.51	+.03
γ Lyræ		1.0	+ .13	1.19	8	12	51.40	.00
ζ Aquilæ	E.	1.0	+ .43	−1.03		18	18.91	−.03
τ Draconis	W.	0.9	−1.96	+3.45	8	36	01.10	+.04
δ Aquilæ		1.0	+ .58	1.00		37	50.57	+.05
β Cygni		1.0	+ .21	1.13		44	13.22	−.06
β Sagittæ	W.	1.0	+ .38	+1.05		53	59.38	.00

Normal equation, $7.8\Delta t - 0.792a_e - 0.594a_w - 0.029c + 9.600 = 0$

Normal equation, $1 \quad -0.102 \quad -0.076 \quad -0.004 + 1.231 = 0$

Adopted $a_w = +1^s.00$ $\quad a_e = +1^s.00$ $\quad c = -0^s.21$

Clock fast $49^s.05$ at $8^h.39$.

[Saint Louis, Mo., August 31, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	O	t			v
					h.	m.	s.	s.
θ Aquilæ	W.	1.0	+0.64	+1.00	9	23	23.49	−.04
o^1 Cygni, seq		1.0	− .20	1.45		25	03.10	−.09
κ Cephei, pr		.8	−2.87	4.58		30	55.51	+.17
ε Delphini	W.	1.0	+ .47	+1.02		45	41.04	−.11
β Delphini	E.	1.0	+0.43	−1.03	9	50	06.25	+.12
α Delphini		1.0	+ .41	1.04		52	14.25	+.02
ε Cygni		1.0	+ .11	1.20		59	29.40	−.03
η Cephei	E.	1.0	− .81	−2.09	10	00	54.91	−.04

Normal equation, $7.8\Delta t - 1.386a_w + 0.140a_e + 1.774c + 10.288 = 0$

Normal equation, $1 \quad -0.178 \quad +0.018 \quad +0.228 + 1.319 = 0$

Adopted $a_w = +0^s.95$ $\quad a_e = +0^s.95$ $\quad c = -0^s.31$

Clock fast $49^s.10$ at $9^h.73$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., September 1, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
χ Draconis	E.	0.9	−1.88	−3.36	7 37 33.79	−.04
β Lyræ		1.0	+ .11	1.20	8 00 08.63	+.02
θ Serpentis, pr		1.0	+ .57	1.00	04 47.10	−.02
γ Lyræ		1.0	+ .13	1.19	08 55.60	−.08
ζ Aquilæ	E.	1.0	+ .43	−1.03	14 23.23	+.11
θ Lyræ	W	1.0	+0.02	+1.27	8 26 37.89	+.16
τ Draconis		.9	−1.96	3.45	32 05.46	+.05
δ Aquilæ		1.0	+ .58	1.00	33 54.78	−.04
β Cygni		1.0	+ .21	1.13	40 17.49	−.08
β Sagittæ	W.	1.0	+ .38	+1.05	50 03.63	−.03

Normal equation, 9.8Δ*t*−0.452a_e−0.674a_w+0.111*c*+13.453=0

Normal equation, 1 −0.046 −0.059 +0.012 + 1.373=0

Adopted a_w=+1ˢ.02 a_e=+1ˢ.19 *c*=−0ˢ.23

Clock fast 49ˢ.25 at 8ʰ.32.

[Saint Louis, Mo., September 1, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
θ Aquilæ	W.	1.0	+0.64	+1.00	9 19 27.67	+.11
o¹ Cygni, seq		1.0	− .20	1.45	24 07.24	−.07
κ Cephei, pr		.8	−2.87	4.58	26 59.63	−.03
ε Delphini	W.	1.0	+ .47	+1.02	41 45.22	+.02
β Delphini	E.	1.0	+0.43	−1.03	9 46 10.39	+.02
α Delphini		1.0	+ .41	1.04	48 18.50	+.02
ε Cygni		1.0	+ .11	1.20	55 33.59	−.07
η Cephei	E.	1.0	− .81	−2.09	56 59.17	.00

Normal equation, 7.8Δ*t*−1.386a_w+0.140a_e+1.774*c*+11.080=0

Normal equation, 1 −0.178 +0.018 +0.228 + 1.420=0

Adopted a_w=+1ˢ.10 a_e=+0ˢ.90 *c*=−0ˢ.26

Clock fast 49ˢ.18 at 9ʰ.66.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., September 2, 1884. Before signals. Observer, Ramel.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
χ Draconis	E.	0.9	−1.88	−3.36	7	34	37.42	−.02
β Lyræ		1.0	+ .11	1.20		57	12.46	+.01
θ Serpentis, pr		1.0	+ .57	1.00	8	00	50.97	+.01
γ Lyræ		1.0	+ .13	1.19		04	59.39	−.08
ζ Aquilæ	E.	1.0	+ .43	−1.03		10	27.00	+.02
θ Lyræ	W.	1.0	+0.02	+1.27	8	22	41.49	−.05
τ Draconis		.9	−1.96	3.45		28	09.10	.00
δ Aquilæ		1.0	+ .58	1.00		29	58.68	+.04
β Cygni		1.0	+ .21	1.13		36	21.40	+.01
β Sagittæ	W.	1.0	+ .38	+1.05		46	07.50	+.03

Normal equation, $9.8\Delta t-0.452a_e-0\ 574a_w+0.111c+10.869=0$

Normal equation, $1 \quad -0.046 \quad -0.059 \quad +0.011 + 1.109=0$

Adopted $a_w=+1^s.00$ $a_e=+1^s.09$ $c=-0^s.22$

Clock fast $49^s.00$ at $8^h.24$.

[Saint Louis, Mo., September 2, 1884. After signals. Observer, Ramel.]

Name of star.	Clamp.	Weight.	A	O	t			v
					h.	m.	s.	s.
θ Aquilæ	W.	1.0	+0.64	+1.00	9	15	31.47	+.05
o¹ Cygni, seq		1.0	-- .20	1.45		20	11.16	+.08
κ Cephei, pr		.8	−2.87	4.58		23	03.13	+.06
ε Delphini	W.	1.0	+ .47	+1.02		37	49.09	−.05
β Delphini	E.	1.0	+0.43	−1.03	9	42	14.16	−.05
α Delphini		1.0	+ .41	1.04		44	22.35	+.03
ε Cygni		1.0	+ .11	1.20		51	37.40	−.10
η Cephei	E.	1.0	− .81	−2.09		52	03.02	−.03

Normal equation, $7.8\Delta t-1.386a_w+0.140a_e+1.774c+8.942=0$

Normal equation, $1 \quad -0.178 \quad +0.018 \quad +0.228 +1.146=0$

Adopted $a_w=+1^s.01$ $a_e=+0^s.93$ $c=-0^s.24$

Clock fast $48^s.93$ at $9^h.60$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., September 25, 1884. Before signals. Observer Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
o¹ Cygni, seq	E.	1.0	−0.20	−1.45	7	49	44.41	−.08
κ Cephei, pr		.8	−2.87	4.58		51	33.50	+.02
γ Cygni		1.0	− .03	1.30		57	48.19	−.12
ε Delphini		1.0	+ .47	1.02	8	07	22.77	+.00
β Delphini		1.0	+ .43	1.03		11	48.37	+.06
α Delphini	E.	1.0	+ .41	−1.04		13	56.45	+.06
α Cygni	W.	1.0	−0.15	+1.41	8	16	10.23	−.06
ε Cygni		1.0	+ .11	1.20		21	11.87	−.18
γ Cephei		1.0	− .81	2.09		22	37.37	+.05
ζ Cygni		1.0	+ .18	1.15		47	36.41	+.07
α Equulei		1.0	+ .56	1.00		49	37.35	+.07
1 Pegasi		1.0	+ .35	1.06		56	18.27	−.02
β Cephei		.9	−1.52	2.93	9	06	46.04	+.01
ε Pegasi	W.	1.0	+ .50	+1.91		18	00.75	+.02

Normal equation, $13.7\Delta t-1.216a_e-0.628a_w+2.053c+18.731=0$

Normal equation, 1 −0.089 −0.046 +0.150 + 1.367=0

Adopted $a_w=+0^s.87$ $a_e=+0^s.87$ $c=-0^s.14$

Clock fast $49^s.23$ at $8^h.44$.

[Saint Louis, Mo., September 25, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Aquarii	W.	1.0	+0.64	+1.00	9	39	17.51	+.01
24 Cephei		.9	−1.75	3.20		47	06.21	+.05
π Aquarii		1.0	+ .61	1.00		58	45.93	−.08
7 Lacertæ	W.	1.0	− .30	+1.55	10	05	56.08	−.10
η Aquarii	E.	1.0	+0.63	−1.00	10	08	46.59	−.03
10 Lacertæ		1.0	.00	1.28		13	26.53	−.01
ζ Pegasi	E.	1.0	+ .48	−1.02		15	02.84	+.15

Normal equation, $6.9\Delta t-0.325a_w+0.810a_e+3.130c+7.742=0$

Normal equation, 1 −0.047 +0.118 +0.454 +1.122=0

Adopted $a_w=+1^s.00$ $a_e=+1^s.00$ $c=-0^s.14$

Clock fast $49^s.13$ at $10^h.02$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., September 28, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
γ Cygni	E.	1.0	−0.03	−1.30	7	46	00.77	−.05
Gr. 3241		.9	−1.80	3.26		58	26.02	+.02
β Delphini		1.0	+ .43	1.03	8	00	01.01	.00
α Delphini		1.0	+ .41	1.04		02	03.14	+.03
ε Cygni	E.	1.0	+ .11	−1.20		09	24.21	−.07
32 Vulpeculæ	W.	1.0	+0.22	+1.13	8	17	29.11	+.04
ν Cygni		1.0	− .05	1.32		20	42.82	+.04
Br. 2777		.8	−2.98	4.65		35	41.84	−.02
α Equulei		1.0	+ .56	1.00		37	50.10	.00
1 Pegasi	W.	1.0	+ .35	+1.06		44	31.03	+.01

Normal equation, $9.7\Delta t-0.700a_e-1.304a_w+0.726c+16.440=0$

Normal equation, $1 \quad -0.072 \quad -0.135 \quad +0.075 + 1.694=0$

Adopted $a_w=+0^s.90$ $a_e=+1^s.00$ $c=-0^s.10$

Clock fast $49^s.49$ at $8^h.22$.

[Saint Louis, Mo., September 28, 1884. After Signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
ε Pegasi	W.	1.0	+0.50	+1.01	9	06	13.52	+.09
π² Cygni		1.0	− .27	1.52		10	15.07	+.01
α Aquarii		1.0	+ .64	1.00		27	30.10	−.05
ζ Cephei	W.	1.0	− .61	+1.87		34	31.33	+.02
7 Lacertæ	E.	1.0	−0.30	−1.55	9	53	07.77	+.01
ζ Pegasi		1.0	+ .48	1.02	10	03	15.15	+.01
η Pegasi		1.0	+ .18	1.15		04	08.44	−.04
ι Cephei	E.	.9	−1.10	−2.42		13	08.48	−.08

Normal equation, $7.9\Delta t+0.260a_w-0.630a_e-0.498c+9.846=0$

Normal equation, $1 \quad +0.033 \quad -0.080 \quad -0.063 +1.246=0$

Adopted $a_w=+0^s75$ $a_e=+0^s.60$ $c=-0^s.28$

Clock fast $49^s.24$ at $9^h.68$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 2, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
β Delphini	E.	1.0	+0.43	−1.03	7	44	15.64	.00
α Delphini		1.0	+ .41	1.04		46	23.74	+.01
ε Cygni		1.0	+ .11	1.20		53	38.67	−.04
η Cephei		1.0	− .81	2.09		55	03.29	−.02
32 Vulpeculæ	E.	1.0	+ .22	−1.13	8	01	43.30	−.05
ν Cygni	W.	1.0	−0.05	+1.32	8	04	58.16	+.05
ζ Cygni		1.0	+ .18	1.15		20	04.52	−.01
α Equulei		1.0	+ .56	1.00		22	05.44	−.06
1 Pegasi		1.0	+ .35	1.06		28	46.39	+.03
β Cephei		.9	−1.53	2.93		39	14.15	+.04
74 Cygni		1.0	− .03	1.30		44	19.21	+.13
ε Pegasi		1.0	+ .50	1.01		50	28.73	−.12
16 Pegasi		1.0	+ .25	1.11		59	45.40	+.04
α Aquarii	W.	1.0	+ .64	+1.00	9	11	45.50	−.06

Normal equation, $13.9\Delta t+0.360a_e+1.023a_w+5.097c+16.091=0$

Normal equation, $1 \quad +0.026 \quad +0.074 \quad +0.367 + 1.157=0$

Adopted $a_w=+0^s.65$ $a_e=+0^s.65$ $c=-0^s.48$

Clock fast $48^s.05$ at $8^h.35$.

[Saint Louis, Mo., October 2, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
7 Lacertæ	W.	1.0	−0.30	+1.55	9	38	24.17	−.02
η Aquarii		1.0	+ .63	1.00		41	14.92	−.05
10 Lacertæ		1.0	.00	1.28		45	55.02	+.08
ζ Pegasi		1.0	+ .48	1.02		47	31.02	−.01
ι Cephei	W.	.9	−1.10	+2.42		57	25.88	+.09
ο Androm	E.	1.0	−0.07	−1.34	10	08	21.94	−.07
π Cephei		.8	−2.25	3.81		16	02.25	+.01
τ Pegasi		1.0	+ .29	1.09		26	37.22	−.01
κ Piscium		1.0	+ .62	1.00		32	41.19	+.01
70 Pegasi	E.	1.0	+ .46	−1.02		34	59.19	+.02

Normal equation, $9.7\Delta t-0.180a_w-0.500a_e-0.470c+11.180=0$

Normal equation, $1 \quad -0.019 \quad -0.052 \quad -0.048 + 1.152=0$

Adopted $a_w=+0^s.79$ $a_e=+0^h.70$ $c=-0^s.48$

Clock fast $48^s.12$ at $10^h.07$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 6, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
ε Delphini	W.	1.0	+0.47	+1.02	7 24 08.38	−.01
β Delphini		1.0	+ .43	1.03	28 34.05	+.02
α Delphini		1.0	+ .41	1.04	30 42.13	+.01
ε Cygni		1.0	+ .11	1.20	37 57.27	+.03
η Cephei		1.0	− .81	2.09	39 22.61	+.09
32 Vulpeculæ	W.	1.0	+ .22	+1.13	46 01.75	−.05
61 Cygni	E.	1.0	+0.01	−1.27	7 58 03.96	−.06
1 Pegasi		1.0	+ .35	1.06	8 13 02.84	+.02
β Cephei		.9	−1.53	2.93	23 28.47	−.12
ε Pegasi		1.0	+ .50	1.01	34 45.35	.00
16 Pegasi		1.0	+ .25	1.11	44 01.78	+.01
α Aquarii	E.	1.0	+ .64	−1.00	56 02.09	−.01

Normal equation, $11.9\Delta t+0.830a_w+0.373a_e-0.577c+12.678=0$

Normal equation, $1 \quad +0.070 \quad +0.031 \quad -0.048+1.065=0$

Adopted $a_w=+0^s.60$ $a_e=+0^s.60$ $c=-0^s.45$

Clock fast $49^s.15$ at $8^h.10$.

[Saint Louis, Mo., October 6, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
π Pegasi	E.	1.0	+0.13	−1.19	9 01 02.32	+.03
24 Cephei		.9	−1.75	3.20	02 48.22	−.01
γ Aquarii		1.0	+ .65	1.00	11 49.85	−.02
π Aquarii	E.	1.0	+ .61	−1.00	15 30.57	−.05
η Aquarii	W.	1.0	+0.63	+1.00	9 25 32.45	−.01
ζ Pegasi		1.0	+ .48	1.02	31 48.51	+.02
η Pegasi		1.0	+ .18	1.15	33 41.98	+.03
ι Cephei	W.	.9	−1.10	+2.42	41 42.99	+.04

Normal equation, $7.8\Delta t-0.185a_e+0.300a_w-0.722c+8.822=0$

Normal equation, $1 \quad -0.024 \quad +0.038 \quad -0.093+1.131=0$

Adopted $a_w=+0^s.65$ $a_e=+0^s.65$ $c=-0^s.47$

Clock fast $49^s.18$ at $9^h.34$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 17, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Aquarii	W.	1.0	+0.64	+1.00	8	13	10.55	+.02
π Pegasi		1.0	+ .12	1.19		18	10.86	−.06
24 Cephei		.9	−1.75	3.20		20	57.71	.00
γ Aquarii	W.	1.0	+ .65	+1.00		28	58.41	+.01
π Aquarii	E.	1.0	+0.61	−1.00	8	32	38.84	−.08
η Aquarii		1.0	+ .63	1.00		42	39.90	+.07
η Pegasi		1.0	+ .18	1.15		50	49.27	+.03
ι Cephei	E.	.9	−1.10	−2.42		58	49.38	−.01

Normal equation, $7.8\Delta t - 0.165a_w + 0.430a_e + 0.742c + 9.536 = 0$

Normal equation, $1 \quad -0.021 \quad +0.055 \quad +0.095 \quad +1.223 = 0$

Adopted $a_w = +0^s.69$ $a_e = +0^s.71$ $c = -0^s.11$

Clock fast $1^m\ 12^s.24$ at $8^h.55$.

[Saint Louis, Mo., October 17, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
o Androm	E.	1.0	−0.07	−1.34	9	09	47.91	+.01
α Pegasi		1.0	+ .42	1.03		11	10.75	+.05
π Cephei		.8	−2.25	3.81		17	28.35	−.03
κ Piscium	E.	1.0	+ .62	−1.00		34	07.12	−.02
70 Pegasi	W.	1.0	+0.46	+1.02	9	36	25.31	+.01
ι Androm		1.0	− .10	1.36		45	34.51	+.01
ι Piscium		1.0	+ .56	1.00		47	05.16	−.05
β Cassiopeæ	W.	1.0	− .65	+1.92	10	15	03.79	−.01

Normal equation, $7.8\Delta t - 0.830a_e + 0.270a_w - 1.118c + 9.946 = 0$

Normal equation, $1 \quad -0.106 \quad +0.035 \quad -0.143 \quad +1.275 = 0$

Adopted $a_w = +0^s.55$ $a_e = +0^s.55$ $c = -0^s.09$

Clock fast $1^m\ 12^s.25$ at $9^h.58$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 18, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
β Cephei	W.	0.9	−1.53	+2.93	7	36	42.76	−.02
ε Pegasi		1.0	+ .50	1.01		47	58.91	+.02
16 Pegasi		1.0	+ .25	1.11		57	15.37	+.01
α Aquarii	W.	1.0	+ .64	+1.00	8	09	15.64	−.01
π Pegasi	E.	1.0	+0.13	−1.18	8	13	15.83	−.09
24 Cephei		.9	−1.75	3.20		17	01.94	+.03
π Aquarii	E.	1.0	+ .61	−1.00		28	44.15	+.05

Normal equation, $6.8\Delta t+0.013a_w-0.835a_e+0.697c+8.867=0$

Normal equation, $1 \quad +0.002 \quad -0.123 \quad +0.102 \quad +1.304=0$

Adopted $a_w=+0^s.65 \qquad a_e=+0^s.57 \qquad c=-0^s.08$

Clock fast $1^m\ 13^s.23$ at $8^h.07$.

[Saint Louis, Mo., October 18, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
η Aquarii	E.	1.0	+0.63	−1.00	8	38	45.08	+.04
10 Lacertæ		1.0	.00	1.28		43	24.72	−.01
ζ Pegasi		1.0	+ .48	1.02		45	01.09	+.02
η Pegasi		1.0	+ .18	1.15		46	54.23	−.21
ι Cephei	E.	.9	−1.10	−2.42		51	54.52	−.03
σ Androm	W.	1.0	−0.07	+1.34	9	05	53.39	+.02
π Cephei		.8	−2.25	3.81		13	34.80	+.05
τ Pegasi		1.0	+ .29	1.09		24	08.53	+.03
70 Pegasi		1.0	+ .46	1.02		32	30.53	+.12
ι Piscium	W.	1.0	− .56	+1.00		43	10.31	.00

Normal equation, $9.7\Delta t+0.300a_e-0.560a_w+0.870c+13.612=0$

Normal equation, $1 \quad +0.031 \quad -0.058 \quad +0.090 + 1.403=0$

Adopted $a_w=+0^s.75 \qquad a_e=+0^s.68 \qquad c=-0^s.11$

Clock fast $1^m\ 13^s.37$ at $9^h.07$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 19, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
β Cephei	W	0.9	−1.53	+2.93	7	32	47.44	−.05
ε Pegasi		1.0	+ .50	1.01		44	03.41	+.02
16 Pegasi		1.0	+ .25	1.11		53	19.86	−.01
α Aquarii	W.	1.0	+ .64	+1.00	8	05	20.12	.00
π Pegasi	E.	1.0	+0.13	−1.19	8	10	20.23	.00
24 Cephei		.9	−1.75	3.20		13	06.69	+.03
γ Aquarii		1.0	+ .65	1.00		21	07.80	+.07
π Aquarii	E.	1.0	+ .61	−1.00		24	48.44	−.04

Normal equation, $7.8\Delta t+0.013a_w-0.185a_e-0.313c+5.267=0$

Normal equation, $1 \quad +0.002 \quad -0.024 \quad -0.040 \quad +0.675=0$

Adopted $a_w=+0^s.75$ $\quad a_e=+0^s.75$ $\quad c=-0^s.10$

Clock fast $1^m\ 13^s.66$ at $8^h.03$.

[Saint Louis, Mo., October 19, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
η Aquarii	E.	1.0	+0.63	−1.00	8	34	49.44	+.06
10 Lacertæ		1.0	.00	1.28		39	29.12	+.08
ζ Pegasi		1.0	+ .48	1.02		41	05.29	−.13
η Pegasi		1.0	+ .18	1.15		42	58.76	−.01
ι Cephei	E.	.9	−1.10	−2.42		50	58.73	−.11
ο Androm	W.	1.0	−0.07	+1.34	9	01	57.75	+.10
π Cephei		.8	−2.25	3.81		09	38.86	+.10
τ Pegasi		1.0	+ .29	1.09		20	12.77	−.05
κ Piscium		1.0	+ .62	1.00		26	16.72	−.06
70 Pegasi	W.	1.0	+ .46	+1.02		28	34.82	+.04

Normal equation, $9.7\Delta t+0.300a_e-0.500a_w+0.870c+5.939=0$

Normal equation, $1 \quad +0.031 \quad -0.052 \quad +0.090 \quad +0.612=0$

Adopted $a_w=+0^s.65$ $\quad a_e=+0^s.65$ $\quad c=-0^s.10$

Clock fast $1^m\ 13^s.59$ at $8^h.99$

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 22, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
β Cephei	E.	0.9	−1.53	−2.93	7	29	57.86	.00
ε Pegasi		1.0	+ .50	1.01		32	14.13	−.00
16 Pegasi		1.0	+ .25	1.11		41	30.72	+.06
α Aquarii	E.	1.0	+ .64	−1.00		53	30.94	−.02
π Pegasi	W.	1.0	+0.13	+1.19	7	58	31.29	−.07
24 Cephei		.9	−1.73	3.20	8	01	18.21	+.06
γ Aquarii		1.0	+ .65	1.00		06	18.90	+.10
π Aquarii	W.	1.0	+ .61	+1.00		12	50.56	−.01

Normal equation, $7.8\Delta t+0.013a_e-0.185a_w+0.312c+11.190=0$

Normal equation, $1 \quad +0.002 \quad -0.024 \quad +0.040 + 1.435=0$

Adopted $a_w=+0^s.84$ $\quad a_e=+0^s.74$ $\quad c=-0^s.05$

Clock fast $1^m\ 12^s.44$ at $7^h.86$.

[Saint Louis, Mo., October 22, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
10 Lacertæ	W.	1.0	0.00	+1.28	8	27	40.33	−.01
ζ Pegasi		1.0	+ .48	1.02		29	16.56	+.01
η Pegasi		1.0	+ .18	1.15		31	08.90	−.11
ι Cephei	W.	.9	−1.10	+2.42		39	10.48	+.04
ο Androm	E.	1.0	−0.07	−1.34	8	50	08.54	+.01
π Cephei		.8	−2.25	3.81		57	49.56	+.05
τ Pegasi		1.0	+ .29	1.09	9	08	23.74	−.03
κ Piscium		1.0	+ .62	1.00		14	27.67	−.07
70 Pegasi		1.0	+ .46	1.02		16	45.67	−.03
ι Androm	E.	1.0	− .10	−1.36		25	54.95	−.03

Normal equation, $9.7\Delta t-0.330a_w-0.600a_e-3.230c+14.72=0$

Normal equation, $1 \quad -0.034 \quad -0.062 \quad -0.333 + 1.518=0$

Adopted $a_w=+0^s.85$ $\quad a_e=+0^s.85$ $\quad c=-0^s.05$

Clock fast $1^m\ 12^s.45$ at $8^h.88$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., October 23, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
β Cephei	E.	0.9	−1.53	−2.93	7	17	02.00	−.02
ε Pegasi		1.0	+ .50	1.01		28	18.18	+.02
16 Pegasi		1.0	+ .25	1.11		37	34.55	−.10
α Aquarii	E.	1.0	+ .64	−1.00		49	34.95	+.06
π Pegasi	W.	1.0	+0.13	+1.19	7	54	35.20	−.10
24 Cephei		.9	−1.75	3.20		56	22.00	.00
γ Aquarii		1.0	+ .65	1.00	8	05	22.89	+.15
π Aquarii	W.	1.0	+ .61	+1.00		09	03.50	−.03

Normal equation, $7.8\Delta t+0.013a_e-0.185a_w+0.313c+10.275=0$

Normal equation, $1 \quad +0.002 \quad -0.024 \quad +0.040 + 1.317=0$

Adopted $a_w=+0^s.84 \qquad a_e=+0^s.84 \qquad c=-0^s.03$

Clock fast $1^m\ 12^s.30$ at $7^h.79$.

[Saint Louis, Mo., October 23, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
η Aquarii	W.	1.0	+0.63	+1.00	8	19	04.47	−.01
10 Lacertæ		1.0	.00	1.28		23	44.24	+.07
ζ Pegasi		1.0	+ .48	1.02		25	20.47	−.04
η Pegasi		1.0	+ .18	1.15		27	13.91	+.04
ι Cephei	W.	.9	−1.10	+2.42		34	14.02	−.02
o Androm	E.	1.0	−0.07	−1.34	8	46	12.30	−.06
π Cephei		.8	−2.25	3.81		53	52.85	−.05
τ Pegasi		1.0	+ .29	1.09	9	04	27.61	+.01
κ Piscium		1.0	+ .62	1.00		10	31.64	+.08
70 Pegasi	E.	1.0	+ .46	−1.02		12	49.53	−.03

Normal equation, $9.7\Delta t+0.300a_w-0.500a_e-0.870c+11.706=0$

Normal equation, $1 \quad +0.031 \quad -0.052 \quad -0.090 + 1.207=0$

Adopted $a_w=+0^s.64 \qquad a_e=+0^s.64 \qquad c=-0^s.06$

Clock fast $1^m\ 12^s.20$ at $8^h.72$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 13, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
η Aquarii	W.	1.0	+0.63	+1.00	6	56	21.78	+.04
ζ Pegasi		1.0	+ .48	1.02	7	02	37.60	+.03
λ Pegasi		1.0	+ .29	1.09		08	53.09	−.10
ι Cephei		.9	−1.10	2.42		12	30.86	−.02
ο Androm	W.	1.0	− .07	+1.34		23	29.65	−.06
π Cephei	E.	0.8	−2.25	−3.81	7	31	09.30	+.02
70 Pegasi		1.0	+ .46	1.02		50	06.79	+.04
ι Androm		1.0	− .10	1.36		59	15.82	−.07
ι Piscium		1.0	+ .56	1.00	8	00	46.75	+.07
ω Piscium	E.	1.0	+ .54	−1.01		20	05.93	+.05

Normal equation, $9.7\Delta t+0.340a_w-0.340a_e-0.810c+7.429=0$

Normal equation, $1 \quad +0.035 \quad -0.035 \quad -0.064 +0.776=0$

Adopted $a_w=+0^s.67 \quad a_e=+0^s.77 \quad c=-0^s.10$

Clock fast $1^m\ 03^s.77$ at $7^h.54$.

[Saint Louis, Mo., November 13, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
β Cassiopeæ	E.	1.0	−0.65	−1.92	8	29	45.21	.00
γ Pegasi		1.0	+ .42	1.03		33	58.44	+.05
σ Androm		1.0	+ .06	1.24		38	58.73	−.03
δ Androm		1.0	+ .17	1.16		59	46.70	.00
ζ Androm	E.	1.0	+ .28	−1.09	9	07	48.99	.00
μ Androm	W.	1.0	+0.01	+1.27	9	16	56.04	+.04
ε Piscium		1.0	+ .52	1.01		23	30.02	−.12
β Androm		1.0	+ .08	1.22		29	49.16	+.07
ν Piscium		1.0	+ .23	1.12		39	38.31	−.02
δ Cassiopeæ	W.	1.0	− .71	+1.98		44	48.80	+.02

Normal equation, $10.0\Delta t+0.280a_e+0.130a_w+0.100c+7.130=0$

Normal equation, $1 \quad +0.028 \quad +0.013 \quad +0.016 +0.713=0$

Adopted $a_w=+0^s.50 \quad a_e+0^s.77 \quad c=-0^s.05$

Clock fast $1^m\ 03^s.74$ at $9^h.14$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 14, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Pegasi	W.	1.0	+0.48	+1.02	6	58	26.83	+.06
η Pegasi		1.0	+ .18	1.15	7	00	20.11	−.09
λ Pegasi		1.0	+ .29	1.09		03	42.34	+.08
ι Cephei	W.	.9	−1.10	+2.42		08	20.32	.00
ο Androm	E.	1.0	−0.07	−1.34	7	19	18.68	+.01
π Cephei		.8	−2.25	3.81		26	58.56	+.09
κ Piscium		1.0	+ .62	1.00		43	37.96	−.02
70 Pegasi		1.0	+ .46	1.02		45	55.99	.00
ι Piscium	E.	1.0	+ .56	−1.00		56	35.83	−.09

Normal equation, $8.7\Delta t-0.040a_w-0.230a_e-1.970c+7.753=0$

Normal equation, $1 \quad -0.005 \quad -0.026 \quad -0.226 \;+0.891=0$

Adopted $a_w=+1^s.90 \qquad a_e=-0^s.74 \qquad c=-0^s.07$

Clock fast $48^s.88$ at $7^h.37$.

[Saint Louis, Mo., November 14, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
φ Pegasi	E.	1.0	+0.36	−1.06	8	09	00.36	+.01
β Cassiopeæ		1.0	− .65	1.92		25	34.04	−.03
γ Pegasi		1.0	+ .42	1.03		29	47.56	−.02
σ Androm	E.	1.0	+ .06	−1.24		34	47.76	−.07
π Androm	W.	1.0	+0.12	+1.19	8	53	10.19	+.16
δ Androm		1.0	+ .17	1.16		55	35.88	−.06
ζ Androm		1.0	+ .28	1.09	9	03	38.23	.00
γ Cassiopeæ		1.0	− .74	2.01		12	11.06	+.02
δ Piscium	W.	1.0	+ .52	+1.01		19	19.13	−.02

Normal equation, $9.0\Delta t+0.190a_e+0.350a_w+1.210c+6.390=0$

Normal equation, $1 \quad +0.021 \quad +0.039 \quad +0.134 \;+0.710=0$

Adopted $a_w=+0^s.69 \qquad a_e=+0^s.50 \qquad c=-0^s.07$

Clock fast $48^s.74$ at $8^h.78$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 15, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
η Aquarii	W.	1.0	+0.63	+1.00	6	48	14.88	−.02
ζ Pegasi		1.0	+ .48	1.02		54	30 95	+.01
η Pegasi		1.0	+ .18	1.15		56	24.27	−.04
λ Pegasi		1.0	+ .29	1.09		59	46.35	−.03
ι Cephei	W.	.9	−1.10	+2.42	7	04	24.14	+.02
o Androm	E.	1.0	−0.07	−1.34	7	15	22.73	−.06
π Cephei		.8	−2.25	3.81		23	02.75	+.02
κ Piscium		1.0	+ .62	1.00		39	42.14	+.09
70 Pegasi		1.0	+ .46	1.02		42	00.07	−.01
ι Piscium	E.	1.0	+ .56	−1.00		52	40.03	+.03

Normal equation, $9.7\Delta t+0.590a_w-0.230a_e-0.970c+8.402=0$

Normal equation, $1 \quad +0.061 \quad -0.024 \quad -0.100 \quad +0.866=0$

Adopted $a_w=+0^s.80 \qquad a_e=+0^s.80 \qquad c=+0^s.05$

Clock fast $48^s.90$ at $7^h.26$.

[Saint Louis, Mo., November 15, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ϕ Pegasi	E.	1.0	+0.36	−1.06	8	05	14.45	−.01
β Cassiopeæ		1.0	− .65	1.92		21	38.46	+.04
γ Pegasi		1.0	+ .42	1.03		25	51.72	+.05
σ Androm	E.	1.0	+ .06	−1.24		30	51.89	−.11
π Androm	W.	1.0	+0.12	+1.19	8	49	14.25	+.03
δ Androm		1.0	+ .17	1.16		51	40.07	−.06
ζ Androm		1.0	+ .28	1.09		59	42.47	+.05
γ Cassiopeæ	W.	1.0	− .74	+2.01	9	08	15.23	+.01

Normal equation, $8.0\Delta t+0.190a_e-0.170a_w+0.200c+6.850=0$

Normal equation, $1 \quad +0.024 \quad -0.021 \quad +0.025 \quad +0.856=0$

Adopted $a_w=+0^s.69 \qquad a_e=+0^s.74 \qquad c=-0^s.07$

Clock fast $48^s.86$ at $8^h.66$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 16, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
η Aquarii	W.	1.0	+0.63	+1.00	6 44 18.31	+.05
η Pegasi		1.0	+ .18	1.15	52 27.60	—.03
λ Pegasi		1.0	+ .29	1.09	55 49.67	—.05
ι Cephei	W.	.9	—1.10	+2.42	7 00 27.37	+.03
o Androm	E.	1.0	—0.07	—1.34	7 11 26.00	—.01
π Cephei		.8	—2.25	3.81	19 05.60	+.04
κ Piscium		1.0	+ .62	1.00	35 45.32	—.03
70 Pegasi		1.0	+ .46	1.02	38 03.34	—.02
ι Piscium	E.	1.0	+ .56	—1.00	48 43.29	+.01

Normal equation, $8.7\Delta t+0.110a_w-0.230a_e-1.990c+9.298=0$

Normal equation, $1 \quad +0.013 \quad -0.026 \quad -0.229 \quad +1.069=0$

Adopted $a_w=+0^s.70$ $\quad a_e=+0^s.70$ $\quad c=-0^s.09$

Clock fast $48^s.08$ at $7^h.23$.

[Saint Louis, Mo., November 16, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
φ Pegasi	E.	1.0	+0.36	- 1.06	8 01 17.75	+.07
β Cassiopeæ		1.0	— .65	1.92	17 41.56	+.02
γ Pegasi		1.0	+ .42	1.03	21 54.87	—.02
σ Androm	E.	1.0	+ .06	—1.24	26 55.20	—.02
π Androm	W.	1.0	+0.12	+1.19	8 45 17.46	—.04
δ Androm		1.0	+ .17	1.16	47 43.19	—.23
ζ Androm		1.0	+ .28	1.09	55 45.74	+.02
γ Cassiopeæ		1.0	— .74	2.01	9 04 18.41	—.03
ε Piscium	W.	1.0	+ .52	+1.01	11 26.90	+.22

Normal equation, $9.0\Delta t-0.190a_e+0.350a_w+1.210c+8.790=0$

Normal equation, $1 \quad -0.021 \quad +0.039 \quad +0.135 \quad +0.977=0$

Adopted $a_w=+0^s.60$ $\quad a_e=+0^s.70$ $\quad c=-0^s.10$

Clock fast $48^s.00$ at $8^h.65$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., December 15, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
γ Trianguli	W.	1.0	+0.11	+1.20	8	29	59.33	−.18
ι Cassiopeæ		.9	−1.21	2.55		39	08.98	−.01
ξ^2 Ceti		1.0	+ .52	1.01		41	30.93	+.21
γ Ceti	W.	1.0	+ .59	+1.00		56	45.97	+.01
ε Arietis	E.	1.0	+0.33	−1.07	9	12	01.70	+.14
α Ceti		1.0	+ .58	1.00		15	38.37	−.01
ρ Persei		1.0	+ .01	1.28		17	11.53	−.16
2 H. Camelopardalis	E.	1.0	− .76	−1.97		39	07.04	+.03

Normal equation, $7.9\Delta t+0.131a_w+0.210a_e+0.185c+9.204=0$

Normal equation, $1 \quad +0.017 \quad +0.027 \quad +0.023 + 1.165=0$

Adopted $a_w=+1^s.00 \qquad a_e=+0^s.88 \qquad c=-0^s.10$

Clock fast $03^s.20$ at $9^h.01$.

[Saint Louis, Mo., December 15, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ξ Tauri	E.	1.0	+0.50	−1.01	9	40	14.48	−.01
f Tauri		1.0	+ .45	1.02		43	49.34	−.01
δ Persei	E.	1.0	− .23	−1.48		54	02.02	+.04
η Tauri	W.	1.0	+0.28	+1.09	9	59	54.85	−.01
ε Persei		1.0	− .02	1.30	10	09	23.26	+.02
c Persei	W.	1.0	− .23	+1.48		19	32.56	−.05

Normal equation, $6.0\Delta t+0.720a_e+0.030a_w+0.360c+5.710=0$

Normal equation, $1 \quad +0.120 \quad +0.005 \quad +0.060 +0.952=0$

Adopted $a_w=+0^s.50 \qquad a_e=+1^s.02 \qquad c=-0^s.13$

Clock fast $03^s.07$ at $9^h.96$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., December 18, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
f Piscium	W.	1.0	+0.58	+1.00	7	20	31.55	+.05
ν Androm		1.0	— .05	1.32		38	40.84	.00
ν Piscium		1.0	+ .56	1.00		44	02.63	+.02
o Piscium		1.0	+ .50	1.01		47	54.36	—.14
ϵ Cassiopeæ	W.	.9	— .92	+2.21		54	45.07	—.05
50 Cassiopeæ	E.	0.9	—1.77	—3.32	8	02	15.12	+.07
γ Androm		1.0	— .07	1.34		05	23.87	+.02
α Arietis		1.0	+ .30	1.09		09	13.48	—.05
ξ^1 Ceti		1.0	+ .51	1.01		15	25.01	—.04
ξ^2 Ceti	E.	1.0	+ .52	—1.01		30	31.12	+.12

Normal equation, $9.8\Delta t+0.762a_w-0.333a_e-1.119c+11.606=0$

Normal equation, $1 \quad +0.078 \quad -0.034 \quad -0.114 \quad +1.184=0$

Adopted $a_w=+0^s.79$ $\quad a_e=+0^s.59$ $\quad c=-0^s.12$

Clock fast $51^s.24$ at $7^h.95$.

[Saint Louis, Mo., December 18, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
γ Ceti	E.	1.0	+0.59	—1.00	8	45	46.26	—.01
μ Ceti		1.0	+ .49	1.01		47	09.14	—.04
η Persei		1.0	— .51	1.76		50	45.69	—.02
ϵ Arietis	E.	1.0	+ .33	—1.07	9	01	01.95	+.03
δ Arietis	W.	1.0	+0.35	+1.06	9	13	25.14	—.02
o Tauri		1.0	+ .51	1.01		26	56.95	—.07
2 H. Camelopardalis		1.0	— .71	1.97		28	07.80	+.02
f Tauri	W.	1.0	+ .45	+1.02		32	50.21	+.11

Normal equation, $8.0\Delta t+0.900a_e+0.600a_w+0.220c+9.100=0$

Normal equation, $1 \quad +0.112 \quad +0.075 \quad +0.027 \quad +1.137=0$

Adopted $a_w=+0^s.69$ $\quad a_e=+0^s.59$ $\quad c=-0^s.15$

Clock fast $51^s.25$ at $9^h.12$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., August 12, 1884. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Ophiuchi	W.	1.0	+ 0.45	+ 1.03	8	02	44.80	—.12
μ Herculis		1.0	+ .22	1.13		15	05.18	+.08
72 Ophiuchi		1.0	+ .49	1.02		34	57.79	—.01
δ Ursæ Minoris	W.	.03	—12.59	+16.95		43	07.74	+.98
o Draconis	E.	.8	— 0.68	— 1.95	9	22	28.17	+.12
γ Lyræ		1.0	+ .13	1.19		27	33.67	—.11
β Cygni	E.	1.0	+ .21	— 1.13		58	55.17	+.05

Normal equation, $5.83\Delta t+0.780a_w-0.200a_e-0.190c+6.16=0$

Normal equation, $1\qquad +0.134\quad -0.034\quad -0.033\quad +1.056=0$

Adopted $a_w=+0^s.85$ $a_e=+0^s.94$ $c=-0^s.43$

Clock fast $49^s.15$ at $8^h.92$.

[Saint Louis, Mo., August 12, 1884. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ξ Draconis	W.	0.8	—0.57	+1.83	8	24	40.34	—.30
67 Ophiuchi		1.0	+ .59	1.00		27	58.05	—.05
o Herculis		1.0	+ .20	1.14		36	07.72	+.01
η Serpentis		1.0	+ .67	1.00		48	23.31	+.22
χ Draconis	W.	0.5	—1.88	+3.36		56	14.67	—.06
R Lyræ	E.	0.9	—0.12	—1.39	9	24	46.31	—.06
ζ Aquilæ		1.0	+ .43	1.19		33	01.23	.00
θ Lyræ		0.9	+ .02	1.27		45	15.39	+.15
τ Draconis	E.	0.4	—1.95	—3.45		50	42.19	+.08

Normal equation, $7.5\Delta t+0.060a_w-0.740a_e+1.320c+9.575=0$

Normal equation, $1\qquad +0.008\quad -0.069\quad +0.176\quad +1.277=0$

Adopted $a_w=+0^s.85$ $a_e=+0^s.94$ $c=-0^s.43$

Clock fast $49^s.14$ at $9^h.04$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., August 13, 1884. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ξ Draconis	E.	0.8	−0.57	−1.83	8	20	42.84	−.23
o Herculis		1.0	+ .20	1.14		32	10.79	+.03
χ Draconis	E.	0.5	−1.88	−3.36		52	16.33	+.25
β Cygni	W.	1.0	+0.21	+1.13	9	55	00.18	−.04
β Sagittæ		1.0	+ .37	1.04	10	04	46.34	+.08
ψ Cygni	W.	.8	− .39	+1.62		21	32.14	−.02

Normal equation, $5.1\Delta t-1.196a_e+0.268a_w-0.818c+6.486=0$

Normal equation, $1 \quad -0.235 \quad +0.052 \quad -0.160 \quad +1.272=0$

Adopted $a_w=+0^s.96 \qquad a_e=+1^s.00 \qquad c=-0^s.46$

Clock fast $49^s.16$ at $9^h.40$.

[Saint Louis, Mo., August 13, 1884. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
72 Ophiuchi	E.	1.0	+ 0.49	− 1.02	8	31	00.83	−.02
δ Ursæ Minoris		0.03	−12.59	16.95		38	57.24	+.67
β Lyræ	E.	1.0	+ .11	− 1.20	9	14	50.75	−.01
δ Aquilæ	W.	1.0	+ 0.58	+ 1.00		48	37.36	+.02
θ Cygni		0.9	− .30	1.56	10	02	17.03	+.04
γ Aquilæ	W.	1.0	+ .48	+ 1.02		09	39.64	−.04

Normal equation, $4.93\Delta t+0.222a_e+0.790a_w+0.696c+4.815=0$

Normal equation, $1 \quad +0.045 \quad +0.160 \quad +0.141 \quad +0.977=0$

Adopted $a_w=+0^s.96 \qquad a_e=+1^s.00 \qquad c=-0^s.46$

Clock fast $49^s.11$ at $9^h.54$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., December 22, 1884. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
ε Cassiopeæ	W.	0.7	−0.92	+2.21	7	39	01.46	+.15
γ Androm		0.9	− .07	1.34		49	40.49	+.07
ξ^1 Ceti		1.0	+ .51	1.01		59	41.40	−.03
γ Arietis		1.0	+ .32	1.07	8	25	00.73	−.10
μ Ceti	W.	1.0	+ .49	+1.01		31	25.58	.00
41 Arietis	E.	1.0	+0.23	−1.12		35	54.26	−.13
α Ceti		1.0	+ .58	1.00		48	54.79	−.08
β Persei		0.9	− .04	1.32		53	20.42	−.04
ζ Arietis		1.0	+ .33	1.07	9	00	54.71	−.09
2 H. Camelopardalis		0.8	− .71	1.97		12	23.50	+.19
5 H. Camelopardalis		0.5	−1.64	3.07		30	50.71	+.02
η Tauri		1.0	+ .28	1.09		33	11.00	−.10
ε Persei		0.9	− .02	1.30		42	39.50	+.03
λ Tauri	E.	1.0	+ .46	−1.02		46	48.25	+.03

Normal equation, $12.7\Delta t+0.613a_w+0.430a_e-4.926c+12.313=0$

Normal equation, $1 \quad +0.048 \quad +0.035 \quad -0.388 + 0.970=0$

Adopted $a_w=+0^s.77 \qquad a_e=+0^s.73 \qquad c=-0^s.18$

Clock fast $51^s.10$ at $8^h.80$.

[Saint Louis, Mo., December 22, 1884. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
50 Cassiopeæ	W.	0.5	−1.77	+3.22	7	46	31.96	−.24
α Arietis		1.0	+ .30	1.09		53	29.75	−.06
β Trianguli		0.9	+ .09	1.21		55	30.50	−.09
θ Arietis		1.0	+ .35	1.06	8	04	30.28	+.04
γ Ceti	W.	1.0	+ .59	+1.00		30	02.50	−.01
ε Arietis	E.	1.0	+0.33	−1.07		45	17.90	+.04
ρ Persei		0.9	+ .01	1.28		50	27.97	+.06
δ Arietis		1.0	+ .35	1.06		57	41.06	+.26
f Tauri		1.0	+ .45	1.02	9	17	05.84	+.07
δ Persei		0.9	− .23	1.48		27	18.33	+.03
9 H. Camelopardalis		0.7	− .77	2.05		39	53.24	−.10
ξ Persei		0.9	+ .07	1.23		44	00.78	−.12
γ Tauri	E.	1.0	+ .41	−1.04		49	31.39	.00

Normal equation, $11.8\Delta t+0.436a_w+0.866a_e-3.367c+9.563=0$

Normal equation, $1 \quad +0.037 \quad +0.073 \quad -0.285 +0.811=0$

Adopted $a_w=+0^s.77 \qquad a_e=+0^s.73 \qquad c=-0^s.18$

Clock fast $50^s.94$ at $8^h.82$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., December 23, 1884. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
δ Arietis	E.	1.0	+0.35	−1.06	8	52	45.57	+.13
o Tauri		1.0	+ .51	1.01	9	06	17.39	+.12
2 H. Camelopardalis		0.8	− .71	1.97		07	27.88	−.08
δ Persei		0.9	− .23	1.48		22	22.97	−.07
η Tauri		1.0	+ .28	1.09		28	15.59	.00
9 H. Camelopardalis		0.7	− .77	2.05		34	58.06	−.11
ξ Persei		0.9	+ .07	1.23		39	05.46	−.13
γ Tauri	E.	1.0	+ .55	−1.01		44	35.88	−.01
c Persei	W.	0.9	−0.23	+1.48		47	53.83	+.03
δ Tauri		1.0	+ .38	1.05	10	03	49.27	.00
τ Tauri		1.0	+ .30	1.08		22	48.63	−.08
μ Eridani		1.0	+ .67	1.01		27	12.41	+.35
9 Camelopardalis		0.6	−1.14	2.48		30	07.83	+.05
ι Aurigæ		1.0	+ .12	1.19		36	56.29	−.22
ι Tauri	W.	1.0	+ .32	+1.07		43	38.03	−.01

Normal equation, $13.8\Delta t+0.439a_e+0.899a_w-1.400c-7.977=0$

Normal equation, $1 \quad +0.032 \quad +0.065 \quad -0.101 \quad -0.578=0$

Adopted $a_w=+0^s.70 \qquad a_e=+0^s.90 \qquad c=-0^s.15$

Clock slow $8^s.49$ at $9^h.83$.

[Saint Louis, Mo., December 23, 1884. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
α Persei	E.	0.9	−0.29	−1.54	9	03	48.59	+.07
f Tauri		1.0	+ .45	1.02		12	10.28	+.13
5 H. Camelopardalis		0.5	−1.64	3.07		25	55.27	−.04
ε Persei		0.9	− .02	1.30		37	43.86	+.07
λ Tauri	E.	1.0	+ .46	−1.02		41	52.39	−.06
γ Tauri	W.	1.0	+0.41	+1.04	10	00	46.18	−.09
ε Tauri		1.0	+ .36	1.06		09	24.12	+.01
m Persei		0.9	− .10	1.36		12	50.04	+.16
4 Camelopardalis		0.8	− .56	1.81		25	55.16	−.28
ι Tauri		1.0	+ .36	1.06		32	05.05	−.08
π^5 Orionis		1.0	+ .59	1.00		35	40.84	−.26
10 Camelopardalis		0.7	− .74	2.02		40	38.71	−.20
ζ Aurigæ		0.9	− .05	1.32		41	52.04	+.08
11 Orionis	W.	1.0	+ .41	+1.04		45	23.87	−.05

Normal equation, $12.6\Delta t-0.189a_e+1.029a_w+4.343c-8.951=0$

Normal equation, $1 \quad -0.015 \quad +0.082 \quad +0.345 \quad -0.709=0$

Adopted $a_w=+0^s.70 \qquad a_e=+0^s.90 \qquad c=-0^s.15$

Clock slow $8^s.72$ at $10^h.09$.

TABLE III.—*Details of time work*—Continued.

[Albuquerque, N. Mex., July 2, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	O	t			v
					h.	m.	s.	s.
χ Virginis	E.	1.0	+0.72	−1.02	14	06	55.72	−.02
α Bootis		1.0	+ .28	1.06		10	34.39	+.02
θ Bootis		.8	− .49	1.64		21	25.40	−.18
π Bootis, pr		1.0	+ .33	1.05		35	29.05	+.13
Gr. 2164	E.	.7	− .83	−1.99		48	40.13	+.22
β Libræ	W.	1.0	+0.70	+1.01	15	10	59.46	−.12
γ Ursæ Minoris		.5	−1.98	3.28		21	03.23	−.06
α Cor. Borealis	W.	1.0	+ .16	+1.12		29	58.91	+.01

Normal equation, $7.0\Delta t+0.357a_e-0.130a_w-2.065c+3.978=0$

Normal equation, $1 \quad +0.051 \quad -0.019 \quad -0.295 \quad +0.568=0$

Adopted $a_w=-0^s.48 \quad a_e=-0^s.35 \quad c=+0^s.00$

Chronometer fast $7^s.56$ at $14^h.73$.

[Albuquerque, N. Mex., July 2, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	O	t			v
					h.	m.	s.	s.
α Scorpii	W.	1.0	+0.98	+1.11	16	22	32.68	−.02
β Herculis		1.0	+ .25	1.08		25	26.85	+.08
ζ Herculis		1.0	+ .07	1.18		37	07.24	+.02
χ Ophiuchi	W.	1.0	+ .44	+1.01		52	24.09	+.12
η Ophiuchi	E.	1.0	+0.80	−1.04	17	03	57.74	−.28
ζ Draconis		.6	−1.25	2.44		08	37.38	−.03
δ Herculis	E.	1.0	+ .19	−1.10		10	28.92	+.09

Normal equation, $6.6\Delta t+1.740a_w+0.240a_e+0.776c+5.364=0$

Normal equation, $1 \quad +0.264 \quad +0.036 \quad +0.118 \quad +0.813=0$

Adopted $a_w=-0^s.35 \quad a_e=-0^s.35 \quad c=0^s.00$

Chronometer fast $7^s.71$ at $16^h.79$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 14, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Pegasi	W.	1.0	+0.48	+1.02	6	58	26.83	+.06
η Pegasi		1.0	+ .18	1.15	7	00	20.11	−.09
λ Pegasi		1.0	+ .29	1.09		03	42.34	+.08
ι Cephei	W.	.9	−1.10	+2.42		08	20.32	.00
ο Androm	E.	1.0	−0.07	−1.34	7	19	18.68	+.01
π Cephei		.8	−2.25	3.81		26	58.56	+.09
κ Piscium		1.0	+ .62	1.00		43	37.96	−.02
70 Pegasi		1.0	+ .46	1.02		45	55.99	.00
ι Piscium	E.	1.0	+ .56	−1.00		56	35.83	−.09

Normal equation, $8.7\Delta t-0.040a_w-0.230a_e-1.970c+7.753=0$

Normal equation, $1 \quad -0.005 \quad -0.026 \quad -0.226 \; +0.891=0$

Adopted $a_w=+1^s.00$ $\qquad a_e=-0^s.74$ $\qquad c=-0^s.07$

Clock fast $48^s.88$ at $7^h.37$.

[Saint Louis, Mo., November 14, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
φ Pegasi	E.	1.0	+0.36	−1.06	8	09	00.36	+.01
β Cassiopeæ		1.0	− .65	1.92		25	34.04	−.03
γ Pegasi		1.0	+ .42	1.03		29	47.56	−.02
σ Androm	E.	1.0	+ .06	−1.24		34	47.76	−.07
π Androm	W.	1.0	+0.12	+1.19	8	53	10.19	+.16
δ Androm		1.0	+ .17	1.16		55	35.88	−.06
ζ Androm		1.0	+ .28	1.09	9	03	38.23	.00
γ Cassiopeæ		1.0	− .74	2.01		12	11.06	+.02
δ Piscium	W.	1.0	+ .52	+1.01		19	19.13	−.02

Normal equation, $9.0\Delta t+0.190a_e+0.350a_w+1.210c+6.390=0$

Normal equation, $1 \quad +0.021 \quad +0.039 \quad +0.134 \; +0.710=0$

Adopted $a_w=+0^s.69$ $\qquad a_e=+0^s.50$ $\qquad c=-0^s.07$

Clock fast $48^s.74$ at $8^h.78$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 15, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
η Aquarii	W.	1.0	+0.63	+1.00	6	48	14.88	−.02
ζ Pegasi		1.0	+ .48	1.02		54	30.95	+.01
η Pegasi		1.0	+ .18	1.15		56	24.27	−.04
λ Pegasi		1.0	+ .29	1.09		59	46.35	−.03
ι Cephei	W.	.9	−1.10	+2.42	7	04	24.14	+.02
o Androm	E.	1.0	−0.07	−1.34	7	15	22.73	−.06
π Cephei		.8	−2.25	3.81		23	02.75	+.02
κ Piscium		1.0	+ .62	1.00		39	42.14	+.09
70 Pegasi		1.0	+ .46	1.02		42	00.07	−.01
ι Piscium	E.	1.0	+ .56	−1.00		52	40.03	+.03

Normal equation, $9.7\Delta t+0.590a_w-0.230a_e-0.970c+8.402=0$

Normal equation, $1 \quad +0.061 \quad -0.024 \quad -0.100 \quad +0.866=0$

Adopted $a_w=+0^s.80$ $a_e=+0^s.80$ $c=+0^s.05$

Clock fast $48^s.90$ at $7^h.26$.

[Saint Louis, Mo., November 15, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ϕ Pegasi	E.	1.0	+0.36	−1.06	8	05	14.45	−.01
β Cassiopeæ		1.0	− .65	1.92		21	38.46	+.04
γ Pegasi		1.0	+ .42	1.03		25	51.72	+.05
σ Androm	E.	1.0	+ .06	−1.24		30	51.89	−.11
π Androm	W.	1.0	+0.12	+1.19	8	49	14.25	+.03
δ Androm		1.0	+ .17	1.16		51	40.07	−.06
ζ Androm		1.0	+ .28	1.09		59	42.47	+.05
γ Cassiopeæ	W.	1.0	− .74	+2.01	9	08	15.23	+.01

Normal equation, $8.0\Delta t+0.190a_e-0.170a_w+0.200c+6.850=0$

Normal equation, $1 \quad +0.024 \quad -0.021 \quad +0.025 \quad +0.856=0$

Adopted $a_w=+0^s.69$ $a_e=+0^s.74$ $c=-0^s.07$

Clock fast $48^s.86$ at $8^h.66$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., November 16, 1884. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
η Aquarii	W.	1.0	+0.63	+1.00	6	44	18.31	+.05
η Pegasi		1.0	+ .18	1.15		52	27.60	—.03
λ Pegasi		1.0	+ .29	1.09		55	49.67	—.05
ι Cephei	W.	.9	—1.10	+2.42	7	00	27.37	+.03
o Androm	E.	1.0	—0.07	—1.34	7	11	26.00	—.01
π Cephei		.8	—2.25	3.81		19	05.60	+.04
κ Piscium		1.0	+ .62	1.00		35	45.32	—.03
70 Pegasi		1.0	+ .46	1.02		38	03.34	—.02
ι Piscium	E.	1.0	+ .56	—1.00		48	43.29	+.01

Normal equation, $8.7\Delta t+0.110a_w-0.230a_e-1.990c+9.298=0$

Normal equation, $1 \quad +0.013 \quad -0.026 \quad -0.229 +1.069=0$

Adopted $a_w=+0^s.70$ $\quad a_e=+0^s.70$ $\quad c=-0^s.09$

Clock fast $48^s.08$ at $7^h.23$.

[Saint Louis, Mo., November 16, 1884. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ϕ Pegasi	E.	1.0	+0.36	—1.06	8	01	17.75	+.07
β Cassiopeæ		1.0	— .65	1.92		17	41.56	+.02
γ Pegasi		1.0	+ .42	1.03		21	54.87	—.02
σ Androm	E.	1.0	+ .06	—1.24		26	55.20	—.02
π Androm	W.	1.0	+0.12	+1.19	8	45	17.46	—.04
δ Androm		1.0	+ .17	1.16		47	43.19	—.23
ζ Androm		1.0	+ .28	1.09		55	45.74	+.02
γ Cassiopeæ		1.0	— .74	2.01	9	04	18.41	—.03
ε Piscium	W.	1.0	+ .52	+1.01		11	26.90	+.22

Normal equation, $9.0\Delta t-0.190a_e+0.350a_w+1.210c+8.790=0$

Normal equation, $1 \quad -0.021 \quad +0.039 \quad +0.135 +0.977=0$

Adopted $a_w=+0^s.60$ $\quad a_e=+0^s.70$ $\quad c=-0^s.10$

Clock fast $48^s.00$ at $8^h.65$.

TABLE III.—*Details of time work*—Continued.

[Albuquerque, N. Mex., July 14, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
β Ursæ Minoris	E.	0.4	−2.40	−3.77	14	51	07.89	−.39
β Bootis		.9	− .13	1.32		57	42.48	+.05
μ Bootis		.9	− .06	1.26	15	20	14.65	+.19
β Cor. Bor	E.	1.0	+ .11	−1.15		23	11.06	+.01
α Cor. Bor	W.	1.0	+0.16	+1.12	15	29	54.94	−.01
α Serpentis		1.0	+ .48	1.01		38	42.23	+.03
κ Serpentis		1.0	+ .30	1.05		43	39.77	+.03
ζ Ursæ Minoris		.3	−3.32	4.87		48	17.52	+.09
ε Cor. Bor	W.	1.0	+ .15	+1.12		52	55.37	−.14

Normal equation, $7.5\Delta t-1.021a_e+0.094a_w+0.781c-0.059=0$

Normal equation, $1 \quad -0.136 \quad +0.013 \quad +0.104 \quad -0.008=0$

Adopted $a_w=+0^s.51$ $a_e=+0^s.51$ $c=+0^s.02$

Chronometer fast $3^s.93$ at $15^h.48$.

[Albuquerque, N. Mex., July 14, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
ε Ophiuchi	W.	1.0	+0.64	+1.00	16	12	20.38	−.06
τ Herculis		.9	− .29	1.45		16	23.14	+.10
η Draconis		.7	− .95	2.11		22	32.39	−.21
β Herculis		1.0	+ .25	1.08		25	22.66	.00
ζ Ophiuchi	W.	1.0	+ .72	+1.02		30	56.03	+.05
Gr. 2377	E.	.8	−0.68	−1.84	16	43	13.38	−.08
κ Ophiuchi		1.0	+ .44	1.01		52	19.67	−.08
ε Ursæ Minoris		.1	−5.41	7.38		57	56.93	+.07
η Ophiuchi		1.0	+ .80	1.04	17	03	53.42	−.11
ζ Draconis		.6	−1.25	2.44		08	34.43	+.13
δ Herculis	E.	1.0	+ .19	−1.10		10	25.05	+.25

Normal equation, $9.1\Delta t+0.684a_w-0.405a_e-0.942c+7.978=0$

Normal equation, $1 \quad +0.075 \quad -0.044 \quad -0.104 \quad +0.877=0$

Adopted $a_w=+0^s.47$ $a_e=+0^s.47$ $c=0^s.00$

Chronometer fast $3^s.89$ at $16^h.67$.

TABLE III.—*Details of time work*—Continued.

[Albuquerque, N. Mex., July 15, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
β Libræ	W.	1.0	+0.70	+1.01	15	10	55.44	+.04
ι Draconis		.8	− .81	1.96		22	27.17	+.07
ν¹ Bootis		.9	− .14	1.33		26	53.31	−.02
α Cor. Bor	W.	1.0	+ .16	+1.12		29	54.86	+.01
β Serpentis	E.	1.0	+0.34	−1.04	15	40	59.11	+.12
θ Draconis		.8	− .78	1.93		59	49.82	−.03
δ Ophiuchi		1.0	+ .62	1.00	16	08	25.77	−.04
ε Ophiuchi	E.	1.0	+ .64	+1.00		12	20.80	−.11

Normal equation, $7.5\Delta t+0.086a_w+0.976a_e+0.311c+6.523=0$

Normal equation, $1 \quad +0.012 \quad +0.130 \quad +0.041 \quad +0.870=0$

Adopted $a_w=-0^s.14 \qquad a_e=-0.14 \qquad c=+0^s.12$

Chronometer fast $3^s.85$ at $15^h.69$.

[Albuquerque, N. Mex., July 15, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
τ Herculis	E.	0.9	−0.29	−1.45	16	16	22.81	−.01
η Draconis		.7	− .95	2.11		22	31.97	.00
β Herculis		1.0	+ .25	1.08		25	22.72	−.07
A Draconis	E.	.6	−1.56	−2.79		28	18.28	+.11
η Herculis	W.	0.9	−0.09	+1.29	16	39	03.23	+.10
Gr. 2377		.8	− .68	1.84		43	12.57	−.13
κ Ophiuchi		1.0	+ .44	1.01		52	19.77	−.08
ε Herculis	W.	1.0	+ .08	+1.17		55	59.54	+.09

Normal equation, $6.9\Delta t-1.612a_e-0.105a_w-0.723c+4.983=0$

Normal equation, $1 \quad -0.234 \quad -0.015 \quad -0.105 \quad +0.722=0$

Adopted $a_w=-0^s.21 \qquad a_e=-0^s.21 \qquad c=+0^s.08$

Chronometer fast $3^s.77$ at $16^h.60$.

TABLE III—*Details of time work*—Continued.

[Albuquerque, N. Mex., July 19, 1884. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Libræ	W.	1.0	+0.80	+1.04	14	44	35.88	−.03
β Ursæ Minoris		.4	−2.40	3.77		51	04.27	−.05
γ Scorpii		1.0	+ .95	1.10		57	25.06	+.08
β Libræ		1.0	+ .70	1.01	15	10	53.98	−.07
γ Ursæ Minoris		.5	−1.98	3.28		20	57.34	−.15
β Cor. Bor	W.	1.0	− .11	+1.15		23	00.72	+.16
α Cor. Bor	E.	1.0	+0.16	−1.12	15	29	53.98	−.05
α Serpentis		1.0	+ .48	1.01		38	41.40	−.05
κ Serpentis		1.0	− .30	1.05		43	38.83	−.06
ε Serpentis		1.0	+ .51	1.00		45	10.33	+.03
ζ Ursæ Minoris		.3	−3.32	4.87		48	15.13	+.07
ε Cor. Bor		1.0	− .15	1.12		52	54.58	−.01
θ Draconis	E.	.8	− .78	−1.93		59	48.97	+.11

Normal equation. $11.0\Delta t-0.616a_w-0.036a_e-0.857c+18.977=0$

Normal equation. $1 \quad -0.055 \quad -0.003 \quad -0.078 + 1.725=0$

Adopted $a_w=-0^s.67$ $a_e=-0^s.67$ $c=+0^s.23$

Chronometer fast $3^s.70$ at $15^h.45$.

[Albuquerque, N. Mex., July 19, 1884. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
η Draconis	E.	0.7	−0.95	−2.11	16	22	31.07	−.20
β Herculis		1.0	+ .25	1.06		25	21.88	+.12
A Draconis		.6	−1.56	2.79		28	17.78	+.13
ζ Ophiuchi	E.	1.0	− .72	−1.03		30	55.17	−.13
η Herculis	W.	0.9	−0.09	+1.29	16	39	02.08	+.28
Gr. 2377		.8	− .68	1.84		43	11.21	−.17
κ Ophiuchi		1.0	− .44	1.01		52	18.47	−.02
ε Herculis	W.	1.0	− .08	+1.17		55	58.11	−.03

Normal equation. $7.0\Delta t-0.631a_e-0.105a_w-0.436c-4.785=0$

Normal equation. $1 \quad -0.090 \quad -0.015 \quad -0.062 \quad -0.684=0$

Adopted $a_w=0^s.00$ $a_e=0^s.00$ $c=+0^s.23$

Chronometer fast $3^s.67$ at $16^h.63$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 2, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
β Cor. Bor	E.	1.0	+0.19	−1.15	8 39 01.71	−.04
ν^1 Bootis		1.0	− .06	1.33	42 43.48	−.11
α Cor. Bor		1.0	+ .22	1.12	45 44.62	+.03
β Serpentis		1.0	+ .40	1.04	56 46.77	+.09
κ Serpentis		1.0	+ .36	1.05	59 27.29	+.05
ζ Ursæ Minoris	E.	.7	−3.10	−4.87	9 04 01.47	.00
ε Cor. Bor	W.	1.0	+0.22	+1.12	9 08 41.84	−.04
Gr. 2320		.9	−1.32	2.68	21 50.45	+.09
σ Cor. Bor		1.0	+ .09	1.21	26 11.76	+.06
19 Ursæ Minoris		.8	−2.55	4.18	29 55.88	−.15
γ Herculis		1.0	+ .35	1.06	32 39.43	+.03
β Herculis		1.0	+ .31	1.08	40 03.83	+.06
σ Herculis	W.	1.0	− .10	+1.36	46 09.85	−.09

Normal equation, $12.4\Delta t - 1.060a_e - 2.358a_w + 2.478c + 26.686 = 0$

Normal equation, $1 \quad -0.085 \quad -0.190 \quad +0.201 + 2.152 = 0$

Adopted $a_w = -0^s.36$ $a_e = -0^s.28$ $c = -0^s.23$

Clock fast 1^m $04^s.20$ at $9^h.19$.

[Saint Louis, Mo., July 2, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	10 07 56.47	−.13
ε Herculis		1.0	+ .15	1.17	11 35.66	+.07
d Herculis		1.0	+ .10	1.20	13 03.64	+.07
ζ Draconis		.9	−1.12	2.44	24 07.41	+.03
δ Herculis	W.	1.0	+ .26	+1.10	25 58.48	+.01
α Ophiuchi	E.	1.0	+0.45	−1.02	10 45 12.47	.00
ι Herculis		1.0	− .19	1.44	51 48.41	+.03
μ Herculis		1.0	+ .21	1.13	57 32.00	+.01
θ Herculis		1.0	+ .03	1.26	11 07 51.32	+.06
35 Draconis		.8	−2.75	4.44	10 08.28	−.05
72 Ophiuchi	E.	1.0	+ .49	−1.01	17 25.30	−.06

Normal equation, $10.7\Delta t - 0.008a_w - 1.210a_e - 2.736c + 23.181 = 0$

Normal equation, $1 \quad -0.001 \quad -0.113 \quad -0.256 + 2.166 = 0$

Adopted $a_w = -0^s.50$ $a_e = -0^s.42$ $c = -0^s.16$

Clock fast 1^m $04^s.25$ at $10^h.68$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 6, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
β Cor. Bor	E.	1.0	+0.19	−1.15	8 23 22.44	+.09
ν¹ Bootis		1.0	− .06	1.33	27 04.10	−.06
α Cor. Bor		1.0	+ .22	1.12	30 05.34	−.04
β Serpentis		1.0	+ .40	1.04	41 07.40	−.04
κ Serpentis		1.0	+ .36	1.05	43 47.87	+.01
ζ Ursæ Minoris	E.	.7	−3.10	−4.87	48 21.57	−.01
ε Cor. Bor	W.	1.0	+0.22	+1.12	8 53 02.47	−.13
σ Cor. Bor		1.0	+ .09	1.21	9 10 32.41	+.16
19 Ursæ Minoris		.8	−2.55	4.18	14 15.65	.00
γ Herculis		1.0	+ .35	1.06	17 00.01	+.02
β Herculis		1.0	+ .31	1.08	25 24.40	+.01
σ Herculis	W.	1.0	− .10	+1.36	30 30.39	−.08

Normal equation, $11.5\Delta t-1.060a_e-1.170a_w+0.075c+27.231=0$

Normal equation, $1 \quad -0.092 \quad -0.102 \quad +0.007 + 2.368=0$

Adopted $a_w=-0^s.42$ $a_e=-0^s.38$ $c=-0^s.21$

Clock fast $1^m\ 08^s.45$ at $8^h.93$.

[Saint Louis, Mo., July 6, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	9 52 17.29	.00
ε Herculis		1.0	+ .15	1.17	55 56.32	+.01
d Herculis		1.0	+ .10	1.20	57 24.29	+.01
ζ Draconis		.9	−1.12	2.44	10 08 28.10	+.01
δ Herculis	W.	1.0	+ .26	+1.10	10 19.18	.00
α Ophiuchi	E.	1.0	+0.45	−1.02	10 29 33.17	+.04
ι Herculis		1.0	− .19	1.44	36 08.98	−.03
μ Herculis		1.0	+ .21	1.13	41 52.57	−.07
ψ Draconis		.9	−1.81	3.27	43 53.45	−.03
θ Herculis		1.0	+ .03	1.26	52 11.97	+.07
35 Draconis		.8	−2.75	4.44	54 28.76	−.04
72 Ophiuchi	E.	1.0	+ .49	−1.01	11 01 46.02	+.02

Normal equation, $11.6\Delta t-0.008a_w-2.839a_e-5.679c+27.780=0$

Normal equation, $1 \quad -0.001 \quad -0.245 \quad -0.490 + 2.395=0$

Adopted $a_w=-0^s.41$ $a_e=-0^s.40$ $c=-0^s.20$

Clock fast $1^m\ 08^s.59$ at $10^h.13$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 7, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
β Cor. Bor	E.	1.0	+0.19	−1.15	8	19	27.42	−.03
ν¹ Bootis		1.0	− .06	1.33		23	09.23	−.03
α Cor. Bor		1.0	+ .22	1.12		26	10.37	+.08
β Serpentis		1.0	+ .40	1.04		37	12.46	+.03
κ Serpentis		1.0	+ .36	1.05		39	52.95	−.03
ζ Ursæ Minoris	E.	.7	−3.10	−4.87		44	26.57	+.01
ε Cor. Bor	W.	1.0	+0.22	+1.12	8	49	07.48	−.15
σ Cor. Bor		1.0	+ .09	1.21	9	06	37.50	+.10
19 Ursæ Minoris		.8	−2.55	4.18		10	20.54	+.02
γ Herculis		1.0	+ .35	1.06		13	05.14	−.02
β Herculis		1.0	+ .31	1.08		21	29.54	+.02
σ Herculis	W.	1.0	− .10	+1.36		26	35.61	+.02

Normal equation, $11.5\Delta t - 1.060a_e - 1.170a_w + 0.075c + 27.622 = 0$

Normal equation, $1 \quad -0.092 \quad -0.102 \quad +0.007 \quad +2.402 = 0$

Adopted $a_w = -0^s.51$ $\quad a_e = -0^s.37$ $\quad c = -0^s.22$

Clock fast $1^m\ 09^s.49$ at $8^h.87$.

[Saint Louis, Mo., July 7, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	9	48	22.31	−.05
ε Herculis		1.0	+ .15	1.17		52	01.29	−.05
d Herculis		1.0	+ .10	1.20		53	29.39	+.07
ζ Draconis		.9	−1.12	2.44	10	.04	33.01	+.04
δ Herculis	W.	1.0	+ .26	+1.10		06	24.19	−.04
α Ophiuchi	E.	1.0	+0.45	−1.02	10	25	35.15	−.07
ι Herculis		1.0	− .19	1.44		32	13.97	−.12
μ Herculis		1.0	+ .21	1.13		37	57.68	−.04
ψ Draconis		.9	−1.81	3.27		39	58.65	+.08
θ Herculis		1.0	+ .03	1.26		48	17.07	+.08
35 Draconis		.8	−2.75	4.44		50	33.84	−.01
72 Ophiuchi	E.	1.0	+ .49	−1.01		57	51.16	+.06

Normal equation, $11.6\Delta t - 0.008a_w - 2.839a_e - 5.679c + 27.216 = 0$

Normal equation, $1 \quad -0.001 \quad -0.245 \quad -0.490 \quad + 2.348 = 0$

Adopted $a_w = -0^s.56$ $\quad a_e = -0^s.43$ $\quad c = -0^s.17$

Clock fast $1^m\ 09^s.54$ at $10^h.38$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 8, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
β Cor. Bor	E.	1.0	+0.19	−1.15	8	15	32.47	−.04
ν¹ Bootis		1.0	− .06	1.33		19	14.23	−.04
α Cor. Bor		1.0	+ .22	1.12		22	15.36	−.01
β Serpentis		1.0	+ .40	1.04		33	17.54	+.06
κ Serpentis		1.0	+ .36	1.05		35	58.02	−.02
ζ Ursæ Minoris	E.	.7	−3.10	−4.87		40	31.23	−.04
ε Cor. Bor	W.	1.0	+0.22	+1.12	8	45	12.50	−.05
σ Cor. Bor		1.0	+ .09	1.21	9	02	42.39	+.08
19 Ursæ Minoris		.8	−2.55	4.18		06	25.13	−.02
γ Herculis		1.0	+ .35	1.06		09	10.09	−.01
β Herculis		1.0	+ .31	1.08		17	24.54	+.06
σ Herculis	W.	1.0	− .10	+1.36		22	40.48	−.02

Normal equation, $11.5\Delta t - 1.060a_e - 1.170a_w + 0.075c + 37.645 = 0$

Normal equation, $1 \quad -0.092 \quad -0.102 \quad +0.007 + 3.273 = 0$

Adopted $a_w = -0^s.56 \qquad a_e = -0^s.51 \qquad c = -0^s.17$

Clock fast $1^m\ 10^s.38$ at $8^h.80$.

[Saint Louis, Mo., July 8, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	9	44	27.49	−.01
ε Herculis		1.0	+ .15	1.17		48	06.39	−.02
d Herculis		1.0	+ .10	1.20		49	34.42	+.04
ζ Draconis		.9	−1.12	2.44	10	00	37.77	−.07
δ Herculis	W.	1.0	+ .26	+1.10		02	29.34	+.02
α Ophiuchi	E.	1.0	+0.45	−1.02	10	21	43.34	+.02
ι Herculis		1.0	− .19	1.44		28	19.03	−.02
μ Herculis		1.0	+ .21	1.13		34	02.70	−.08
ψ Draconis		.9	−1.81	3.27		36	03.23	+.11
θ Herculis		1.0	+ .03	1.26		44	22.05	+.05
35 Draconis		.8	−2.75	4.44		46	38.25	−.04
72 Ophiuchi	E.	1.0	+ .49	−1.01		53	56.27	+.04

Normal equation, $11.6\Delta t - 0.008a_w - 2.839a_e - 5.679c + 37.664 = 0$

Normal equation, $1 \quad -0.001 \quad -0.245 \quad -0.490 + 3.247 = 0$

Adopted $a_w = -0^s.73 \qquad a_e = -0^s.63 \qquad c = -0^s.19$

Clock fast $1^m\ 10^s.49$ at $10^h.31$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 14, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
β Serpentis	W.	1.0	+0.40	+1.04	8	09	49.23	−.02
ζ Ursæ Minoris		.7	−3.10	4.87		17	03.29	+.04
ε Cor. Bor.		1.0	+ .22	1.12		21	43.90	+.02
γ Herculis		1.0	+ .35	1.06		45	41.70	+.24
η Draconis		1.0	− .83	2.11		51	14.83	−.24
β Herculis		1.0	+ .31	1.08		58	05.75	−.06
σ Herculis	W.	1.0	− .10	+1.36		59	11.81	+.03
η Herculis	E.	1.0	−0.01	−1.29	9	07	43.69	+.05
κ Ophiuchi		1.0	+ .49	1.01		20	58.36	−.03
ε Herculis		1.0	+ .15	1.17		24	37.35	−.01
ε Ursæ Minoris		.6	−5.09	7.38		26	27.76	+.06
α Herculis	E.	1.0	+ .42	−1.03		38	06.26	−.04

Normal equation, $11.3\Delta t - 1.820a_w - 2.004a_e + 2.251c + 46.174 = 0$

Normal equation, $1 \quad -0.161 \quad -0.177 \quad +0.199 + 4.086 = 0$

Adopted $a_w = -0^s.65$ $a_e = -0^s.60$ $c = -0^s.14$

Clock fast $1^m\ 17^s.27$ at $8^h.85$.

[Saint Louis, Mo., July 14, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
α Ophiuchi	E.	1.0	+0.45	−1.02	9	58	14.69	+.09
ι Herculis		1.0	− .19	1.44	10	04	50.48	−.01
μ Herculis		1.0	+ .21	1.13		10	34.08	−.05
γ Draconis	E.	1.0	− .36	−1.61		22	30.68	+.05
α Lyræ	W.	1.0	0.00	+1.28	11	01	31.43	−.14
110 Herculis		1.0	+ .33	1.07		09	10.66	+.10
β Lyræ		1.0	+ .11	1.19		14	16.88	−.04
o Draconis		1.0	− .69	1.96		17	56.55	+.08
γ Lyræ		1.0	+ .13	1.19		23	03.99	+.04
ζ Aquilæ	W.	1.0	+ .43	+1.03		28	32.13	−.11

Normal equation, $10.0\Delta t + 0.110a_e + 0.310a_w + 2.520c + 4.670 = 0$

Normal equation, $1 \quad +0.011 \quad +0.031 \quad +0.252 + 0.467 = 0$

Adopted $a_w = -0^s.75$ $a_e = -0^s.32$ $c = -0^s.19$

Clock fast $1^m\ 17^s.39$ at $10^h.82$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 15, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	s.
κ Serpentis	W.	1.0	+0.36	+1.05	8 08 34.90	−.04
ζ Ursæ Minoris		.7	−3.10	4.87	13 08.58	+.04
ε Cor. Bor		1.0	+ .22	1.12	17 49.05	.00
σ Cor. Bor	W.	1.0	+ .09	+1.21	35 18.84	+.06
19 Ursæ Minoris	E.	0.8	−2.55	−4.18	8 38 00.17	.00
γ Herculis		1.0	+ .35	1.06	41 46.26	+.02
β Herculis		1.0	+ .31	1.08	50 10.64	+.03
σ Herculis		1.0	− .10	1.36	55 16.51	−.05
η Herculis	E.	1.0	− .01	−1.29	9 03 48.79	−.01

Normal equation, $8.5\Delta t - 1.500a_w - 1.490a_e - 1.345c + 18.015 = 0$

Normal equation, $1 \quad -0.176 \quad -0.176 \quad -0.158 + 2.119 = 0$

Adopted $a_w = -0^s.63 \qquad a_e = -0^s.47 \qquad c = -0^s.15$

Clock fast $1^m\ 18^s.33$ at $8^h.50$.

[Saint Louis, Mo., July 15, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	s.
ε Ursæ Minoris	E.	0.6	−5.09	−7.38	9 22 32.85	+.02
α Herculis		1.0	+ .42	1.03	34 11.49	+.02
π Herculis		1.0	+ .04	1.25	35 49.08	+.01
α Ophiuchi		1.0	+ .45	1.02	54 19.79	−.04
ι Herculis	E.	1.0	− .19	−1.44	10 00 55.60	+.03
μ Herculis	W.	1.0	+0.21	+1.13	10 06 39.61	−.09
ψ Draconis		.9	−1.81	3.27	08 40.60	−.03
θ Herculis		1.0	+ .03	1.26	16 59.03	+.07
72 Ophiuchi		1.0	+ .49	1.01	26 33.15	+.02
o Herculis	W.	1.0	+ .20	+1.14	27 42.23	.00

Normal equation, $9.5\Delta t - 2.334a_e - 0.699a_w - 1.685c + 39.781 = 0$

Normal equation, $1 \quad -0.246 \quad -0.074 \quad -0.177 + 4.188 = 0$

Adopted $a_w = -0^s.63 \qquad a_e = -0^s.56 \qquad c = -0^s.17$

Clock fast $1^m\ 18^s.40$ at $10^h.00$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 19, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	
β Serpentis	E.	1.0	+0.40	—1.04	7	50	14.82	+.03
κ Serpentis		1.0	+ .36	1.05		52	55.22	—.10
ζ Ursæ Minoris		.7	—3.10	4.87		57	27.63	+.03
ε Cor. Bor.		1.0	+ .22	1.12	8	02	09.35	—.05
σ Cor. Bor.	E.	1.0	+ .09	—1.21		19	39.30	+.17
19 Ursæ Minoris	W.	0.8	—2.55	+4.18	8	23	21.44	+.09
γ Herculis		1.0	+ .35	1.06		26	07.24	—.07
β Herculis		1.0	+ .31	1.08		34	31.67	+.01
σ Herculis		1.0	— .10	1.36		39	37.52	—.09
η Herculis		1.0	— .01	1.29		48	09.67	—.16
49 Herculis		1.0	+ .41	1.04		56	02.68	+.13
κ Ophiuchi	W.	1.0	+ .49	+1.01	9	01	24.58	+.03

Normal equation, $11.5\Delta t - 1.100a_e - 0.590a_w + 2.355c + 30.559 = 0$

Normal equation, $1 \quad -0.096 \quad -0.051 \quad +0.205 + 2.657 = 0$

Adopted $a_w = -0^s.62 \qquad a_e = -0^s.59 \qquad c = -0^s.13$

Clock fast $1^m\ 22^s.72$ at $8^h.41$.

[Saint Louis, Mo., July 19, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ε Ursæ Minoris	W.	0.6	—5.09	+7.38	9	06	55.22	+.04
α Ophiuchi		1.0	+ .45	1.02		38	40.91	+.16
ι Herculis		1.0	— .19	1.44		45	16.51	—.07
β Ophiuchi		1.0	+ .56	1.00		46	51.35	+.07
μ Herculis		1.0	+ .21	1.13		51	00.26	—.18
θ Herculis	W.	1.0	+ .03	+1.26	10	01	19.55	+.03
109 Herculis	E.	1.0	+ .31	—1.08	10	27	44.62	+.03
χ Draconis		.9	—1.88	3.36		32	03.03	—.18
110 Herculis		1.0	+ .33	1.07		49	35.99	+.02
β Lyræ		1.0	+ .11	1.19		54	42.31	.00
R Lyræ	E.	1.0	— .12	—1.39	11	00	41.43	+.08

Normal equation, $10.5\Delta t - 1.994a_w - 1.062a_e - 2.524c + 26.912 = 0$

Normal equation, $1 \quad -0.190 \quad -0.101 \quad -0.240^s + 2.563 = 0$

Adopted $a_w = -0^s.53 \qquad a_e = -0^s.62 \qquad c = -0^s.11$

Clock fast $1^m\ 22^s.70$ at $10^h.21$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., June 10, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
τ Bootis	E.	1.0	+0.37	−1.05	8	24	18.28	−.02
η Ursæ Majoris		1.0	− .30	1.55		25	28.90	−.11
α Draconis		0.9	−1.05	2.36		43	40.40	+.02
d Bootis	E.	1.0	+ .25	−1.11		47	35.73	+.14
4 Ursæ Minoris	W.	0.7	−3.08	+4.84		51	36.49	−.01
λ Bootis		1.0	− .20	1.46		55	24.65	+.14
ρ Bootis		1.0	+ .16	1.16	9	09	14.95	−.04
π Bootis, pr		1.0	+ .39	1.04		17	41.09	−.09
ε Bootis	W.	1.0	+ .22	+1.13		22	18.53	−.02

Normal equation, $8.6\Delta t - 0.625a_e - 1.586a_w + 2.344c + 22.958 = 0$

Normal equation, $1 \quad -0.073 \quad -0.184 \quad +0.273 + 2.669 = 0$

Adopted $a_w = -2^s.72$ $\quad a_e = -2^s.61$ $\quad c = +0^s.01$

Clock fast $50^s.36$ at $8^h.88$.

[Saint Louis, Mo., June 10, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
δ Bootis	W.	1.0	+0.10	+1.20	9	53	07.36	−.10
μ^1 Bootis		1.0	+ .02	1.26	10	02	22.50	+.06
ι Draconis		1.0	− .69	1.96		04	34.06	+.09
α Cor. Bor		1.0	+ .22	1.12		12	01.83	.00
α Serpentis	W.	1.0	+ .53	+1.01		20	48.42	−.01
ε Cor. Bor	E.	1.0	+0.22	−1.12		34	58.80	+.01
θ Draconis		1.0	− .67	1.93		41	50.17	−.01
δ Ophiuchi		1.0	+ .67	1.00		50	27.14	−.12
σ Cor. Bor		1.0	+ .09	1.21		52	28.50	+.09
γ Herculis	E.	1.0	+ .35	−1.06		58	56.50	+.05

Normal equation, $10\Delta t + 0.180a_w + 0.660a_e + 0.230c + 29.270 = 0$

Normal equation, $1 \quad +0.018 \quad +0.066 \quad +0.023 + 2.927 = 0$

Adopted $a_w = -2^s.72$ $\quad a_e = -2^s.58$ $\quad c = +0^s.11$

Clock fast $50^s.70$ at $10^h.45$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., June 10, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. *m.* *s.*	
ζ Virginis	E.	1.0	+0.62	−1.00	13 29 24.34	—.02
η Ursæ Majoris		0.9	— .30	1.55	43 33.95	—.02
η Bootis		1.0	+ .36	1.06	49 46.62	—.01
τ Virginis		1.0	+ .60	1.00	56 22.07	—.02
α Draconis	E.	0.7	—1.05	—2.36	14 01 49.64	—.04
4 Ursæ Minoris	W.	0.3	—3.08	+4.84	09 49.22	+.22
θ Bootis		0.8	— .39	1.64	21 49.83	+.01
ρ Bootis		1.0	+ .16	1.16	27 25.93	—.05
π Bootis, pr.		1.0	+ .39	1.05	35 53.18	+.01
π' Virginis	W.	1.0	+ .69	+1.00	37 34.40	+.02

Normal equation, $8.7\ \Delta t+0.575a_e+0.004a_w-0.133c+32.788=0$

Normal equation, $1 \quad +0.066 \quad +0.000 \quad -0.015+3.769=0$

Adopted $a_w=-0^s.62$ $\quad a_e=-0^s.62$ $\quad c=+0^s.21$

Chronometer fast $31^s.73$ at $14^h.12$.

[Saint Louis, Mo., June 10, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. *m.* *s.*	*s.*
3 Serpentis	W.	1.0	+0.55	+1.00	15 10 02.54	—0.02
1 H. Ursæ Minoris		.6	—1.29	2.65	13 51.90	— .27
β Cor. Bor.		1.0	+ .18	1.15	23 38.87	— .20
α Serpentis		1.0	+ .53	1.01	39 10.48	+ .02
μ Serpentis		1.0	+ .67	1.00	44 11.65	+ .10
ζ Ursæ Minoris	W.	0.3	—3.10	+4.87	48 44.19	+ .37
δ Scorpii	E.	1.0	+0.94	—1.08	54 07.52	+ .02
θ Draconis		0.8	— .67	1.93	16 00 18.50	— .11
δ Ophiuchi		1.0	+ .67	1.00	08 54.10	— .01
ε Ophiuchi		1.0	+ .68	1.00	12 49.20	+ .01
τ Herculis	E.	0.9	— .20	—1.46	16 51.67	+ .22

Normal equation, $9.6\Delta t+0.226a_w+1.574a_e+1.273c+27.221=0$

Normal equation, $1 \quad +0.024 \quad +0.164 \quad +0.133+2.838=0$

Adopted $a_w=-0^s.37$ $\quad a_e=-0^s.37$ $\quad c=+0^s.24$

Chronometer fast $31^s.80$ at $15^h.79$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., June 12, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
τ Bootis	E.	1.0	+0.37	−1.05	8 16 21.10	+.03
η Ursæ Majoris		1.0	− .30	1.55	17 32.71	−.14
η Bootis		1.0	+ .36	1.06	23 44.61	+.01
α Draconis		0.9	−1.05	2.36	35 45.45	+.02
d Bootis	E.	1.0	+ .25	−1.11	39 38.68	+.15
4 Ursæ Minoris	W.	0.7	−3.08	+4.84	43 43.52	−.09
λ Bootis		1.0	− .20	1.46	46 27.89	−.10
ρ Bootis		1.0	+ .16	1.16	9 01 17.85	+.06
π Bootis, pr		1.0	+ .39	1.04	09 43.69	+.07
ε Bootis	W.	1.0	+ .22	+1.13	14 21.30	−.01

Normal equation, $9.6\Delta t - 0.265a_e - 1.586a_w + 1.284c + 33.801 = 0$

Normal equation, $1 - 0.028 \quad -0.165 \quad +0.134 + 3.521 = 0$

Adopted $a_w = -0^s.65 \qquad a_e = -0^s.71 \qquad c = +0^s.18$

Clock fast $45^s.67$ at $8^h.71$.

[Saint Louis, Mo., June 12, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*	*v*
					h. m. s.	*s.*
β Bootis	W.	1.0	−0.05	+1.32	9 31 57.02	−.01
ψ Bootis		1.0	+ .22	1.13	33 51.32	+.03
δ Bootis		1.0	+ .10	1.20	45 10.34	+.07
γ^2 Ursæ Minoris		.9	−1.82	3.28	55 10.12	+.02
β Cor. Bor	W.	1.0	+ .19	+1.15	57 21.64	−.04
ν^1 Bootis	E.	1.0	−0.06	−1.33	10 01 04.06	−.03
α Cor. Bor		1.0	+ .22	1.12	03 05.08	+.06
χ Serpentis		1.0	+ .36	1.05	17 47.66	+.03
ζ Ursæ Minoris	E.	0.7	−3.10	−4.87	22 23.45	−.10

Normal equation, $8.6\Delta t - 1.178a_w - 1.650a_e + 0.843c + 20.956 = 0$

Normal equation, $1 \quad -0.137 \quad -0.192 \quad +0.098 + 2.437 = 0$

Adopted $a_w = -0^s.74 \qquad a_e = -0^s.65 \qquad c = +0^s.23$

Clock fast $45^s.68$ at $9^h.92$

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., June 12, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Virginis	W.	1.0	+0.62	+1.00	13	29	22.38	+.09
η Ursæ Majoris		.9	— .30	1.55		43	31.90	—.02
η Bootis		1.0	+ .36	1.06		49	44.59	—.02
τ Virginis		1.0	+ .60	1.00		56	20.07	+.04
α Draconis	W.	0.7	—1.05	+2.36	14	01	47.60	+.12
d Bootis	E.	1.0	+0.25	—1.11		05	41.73	+.04
4 Ursæ Minoris		0.3	—3.08	4.84		09	50.63	—.37
θ Bootis		0.8	— .39	1.64		21	49.12	—.08
ρ Bootis		1.0	+ .16	1.16		27	24.83	—.08
π Bootis, pr	E.	1.0	+ .39	—1.05		35	52.01	+.05

Normal equation, $8.7\Delta t+0.575a_w-0.436a_e+0.023c+11.255=0$

Normal equation, $1 \quad +0.066 \quad -0.050 \quad +0.003 + 1.294=0$

Adopted $a_w=-0^s.31 \qquad a_e=-0^s.12 \qquad c=+0^s.21$

Chronometer fast $30^s.28$ at $14^h.06$.

[Saint Louis, Mo., June 12, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
β Bootis	E.	0.9	—0.05	—1.32	14	58	09.27	+.12
β Libræ		1.0	+ .75	1.01	15	11	22.15	—.08
γ Ursæ Minoris		0.5	—1.82	3.28		21	27.32	—.29
β Cor. Bor.		1.0	+ .19	1.15		23	37.87	+.08
ν^1 Bootis	E.	0.9	— .06	—1.33		27	20.50	+.14
α Serpentis	W.	1.0	+0.53	+1.01		39	08.87	+.05
μ Serpentis		1.0	+ .67	1.00		44	09.86	—.04
ζ Ursæ Minoris		0.3	—3.10	4.87		48	43.09	+.37
δ Scorpii		1.0	+ .94	1.08		54	05.25	—.07
θ Draconis	W.	0.8	— .67	+1.93	16	00	16.00	—.21

Normal equation, $8.4\Delta t-0.069a_e+0.674a_w-0.090c+9.409=0$

Normal equation, $1 \quad -0.008 \quad +0.080 \quad -0.011 +1.120=0$

Adopted $a_w=-0^s.30 \qquad a_e=-0^s.30 \qquad c=+0^s.14$

Chronometer fast $30^s.10$ at $15^h.53$.

TABLE III—*Details of time work*—Continued.

[St. Louis, Mo., June 14, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	*s.*
β Bootis	E.	1.0	−0.05	−1.32	9	24	07.44	+.12
ψ Bootis		1.0	+ .22	1.13		26	01.58	+.11
β Libræ		1.0	+ .75	1.01		37	18.49	−.05
γ^2 Ursæ Minoris		0.9	−1.82	3.28		47	21.61	+.39
β Cor. Bor		1.0	+ .19	1.15		49	31.83	−.05
ν^1 Bootis	E.	1.0	− .06	−1.33		53	13.71	−.04
α Serpentis	W.	1.0	+0.53	+1.01	10	05	00.30	−.19
β Serpentis		1.0	+ .40	1.04		07	16.45	−.06
χ Serpentis		1.0	+ .36	1.05		09	56.98	−.07
ζ Ursæ Minoris		0.7	−3.10	4.87		14	31.70	−.09
ε Cor. Bor		1.0	+ .22	1.12		19	11.10	−.08
σ Cor. Bor	W.	1.0	+ .09	+1.21		36	40.96	+.05

Normal equation, $11.6\Delta t - 0.588a_e - 0.570a_w - 0.053c + 37.833 = 0$

Normal equation, $1 \quad -0.051 \quad -0.049 \quad -0.005 + 3.261 = 0$

Adopted $a_w = -0^s58$ $\quad a_e = -0^s.65$ $\quad c = +0^s.12$

Clock fast $47^s.32$ at $9^h.95$.

[Saint Louis, Mo., June 14, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	*m.*	*s.*	
ε Ophiuchi	W.	1.0	+0.68	+1.00	10	38	33.09	−.07
19 Ursæ Minoris		0.8	−2.55	4.18		40	24.06	−.03
β Herculis		1.0	+ .31	1.08		51	33.06	+.10
σ Herculis		1.0	− .10	1.36		56	39.03	−.04
η Herculis	W.	1.0	− .01	+1.29	11	05	11.17	−.06
κ Ophiuchi	E.	1.0	+0.49	−1.01		18	26.16	.00
ε Herculis		1.0	+ .15	1.17		22	05.20	−.01
d Herculis		1.0	+ .10	1.20		23	33.27	+.08
ζ Draconis		.9	−1.12	2.44		34	37.16	+.01
δ Herculis	E.	1.0	+ .26	−1.10		36	28.07	+.03

Normal equation, $9.7\Delta t - 1.160a_w - 0.008a_e + 1.398c + 22.477 = 0$

Normal equation, $1 \quad -0.120 \quad -0.000 \quad +0.144 + 2.317 = 0$

Adopted $a_w = -0^s.38$ $\quad a_e = -0^s.56$ $\quad c = +0^s.19$

Clock fast $47^s.39$ at $11^h.11$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., June 14, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
β Ursæ Minoris	W.	0.4	—2.22	+3.77	14	51	31.75	—.18
γ Scorpii		1.0	+ .99	1.10		57	51.37	+.01
ψ Bootis		1.0	+ .22	1.13	15	00	01.11	+.09
β Libræ		1.0	+ .75	1.01		11	19.67	—.06
1 H. Ursæ Minoris	W.	0.6	—1.29	+2.65		13	48.75	+.07
γ Ursæ Minoris	E.	0.5	—1.82	—3.28		21	25.34	—.26
ν^1 Bootis		0.9	— .06	1.33		27	18.34	+.10
α Serpentis		1.0	+ .53	1.01		39	06.88	—.05
μ Serpentis		1.0	+ .67	1.00		44	07.99	.00
ζ Ursæ Minoris	E.	0.3	—3.10	—4.87		48	42.52	+.32

Normal equation, $7.7\Delta t+0.298a_w+0.694a_e+0.030c+7.404=0$

Normal equation, 1 —0.039 —0.090 +0.004 +0.962=0

Adopted $a_w=-0^s.20$ $a_e=-0^s.20$ $c=+0^s.15$

Chronometer fast $27^s.97$ at $15^h.32$.

[Saint Louis, Mo., June 14, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	A	C	t			v
					h.	m.	s.	s.
δ Ophiuchi	E.	1.0	+0.67	—1.00	16	08	50.04	+.01
ε Ophiuchi		1.0	+ .68	1.00		12	45.11	—.01
τ Herculis		0.9	— .20	1.46		16	47.64	+.22
η Draconis	E.	0.7	— .83	—2.11		22	56.68	—.23
A Draconis	W.	0.6	—1.41	+2.79		28	42.82	+.30
ζ Herculis		1.0	+ .14	1.18		37	27.15	—.10
Gr. 2377		0.8	— .58	1.84		43	36.95	—.15
κ Ophiuchi		1.0	+ .49	1.01		52	43.90	+.01
ε Herculis	W.	1.0	+ .15	+1.17		56	23.62	+.03

Normal equation, $8.0\Delta t+0.598a_e-0.530a_w+1.715c+6.720=0$

Normal equation, 1 +0.074 —0.066 +0.214 +0.840=0

Adopted $a_w=-0^s.25$ $a_e=-0^s.25$ $c=0^s.17$

Chronometer fast $27^s.87$ at $16^h.52$

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 24, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
19 Ursæ Minoris	E.	0.8	−2.55	−4.18	8	03	45.27	+.30
η Draconis		1.0	− .83	2.11		12	05.12	−.25
β Herculis		1.0	+ .31	1.08		14	56.65	−.07
ζ Ophiuchi		1.0	+ .77	1.02		20	29.59	−.15
η Herculis		1.0	− .01	1.29		28	34.74	−.03
κ Ophiuchi	E.	1.0	+ .49	−1.01		41	49.51	−.16
ε Ursæ Minoris	W.	0.6	−5.09	+7.38		47	19.36	+.34
α Herculis		1.0	+ .42	1.03		58	57.81	+.07
δ Herculis		1.0	+ .26	1.10		59	51.75	+.10
π Herculis		1.0	+ .04	1.25	9	00	35.36	+.04
b Ophiuchi		1.0	+ .97	1.09		08	53.76	−.06
β Draconis		1.0	− .39	1.64		17	19.97	+.05
α Ophiuchi	W.	1.0	+ .45	+1.02		19	06.16	+.05

Normal equation, $12.4\Delta t-1.310a_e-1.304a_w+1.704c+30.440=0$

Normal equation, $1 \quad -0.106 \quad -0.105 \quad +0.137 + 2.455=0$

Adopted $a_w=-0^s.68$ $\quad a_e=-0^s.76$ $\quad c=-0^s.10$

Clock fast $1^m\ 27^s.59$ at $8^h.76$.

[Saint Louis, Mo., July 24, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ι Herculis	W.	1.0	− 0.19	+ 1.44	9	25	41.94	−.05
β Ophiuchi		1.0	+ .56	1.00		27	16.79	−.05
ψ Draconis		0.9	− 1.81	3.27		33	26.13	+.03
θ Herculis	W.	1.0	+ .03	+ 1.26		41	44.86	−.06
72 Ophiuchi	E.	1.0	+ 0.49	− 1.01		51	18.86	−.06
o Herculis		1.0	+ .20	1.14		52	27.79	−.14
δ Ursæ Minoris		0.3	−12.59	16.94		58	43.71	+.03
109 Herculis		1.0	+ .31	1.08	10	08	09.96	−.04
χ Draconis		0.9	− 1.88	3.36		12	28.24	+.05
α Lyræ		1.0	.00	1.28		22	22.33	+.02
110 Herculis		1.0	+ .33	1.07		30	01.45	+.17
β Lyræ	E.	1.0	+ .11	− 1.19		35	07.74	+.12

Normal equation, $11.1\Delta t-1.229a_w-4.029a_e-8.233c+24.965=0$

Normal equation, $1 \quad -0.111 \quad -0.363 \quad -0.742 + 2.249=0$

Adopted $a_w=-0^s.72$ $\quad a_e=-0^s.69$ $\quad c=-0^s.15$

Clock fast $1^m\ 27^s.69$ at $9^h.98$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 24, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	
η Draconis	W.	0.7	−0.83	+2.11	16	22	34.21	−.07
β Herculis		1.0	+ .31	1.08		25	25.76	+.04
A Draconis		0.6	−1.41	2.79		28	20.27	+.07
ζ Ophiuchi		1.0	+ .77	1.02		30	59.38	−.07
Gr. 2377		0.8	− .58	1.84		43	15.57	+.09
49 Herculis	W.	1.0	+ .41	+1.04		47	00.26	+.12
ε Ursæ Minoris	E.	0.1	−5.09	−7.38		57	57.08	−.36
η Ophiuchi		1.0	+ .84	1.04	17	03	57.24	−.22
ζ Draconis		0.6	−1.12	2.44		08	37.28	+.21
δ Herculis		1.0	+ .26	1.10		10	28.44	+.10
θ Ophiuchi		1.0	+ .99	1.10		15	07.43	−.17
α Ophiuchi	E.	1.0	+ .45	−1.02		29	45.92	+.05

Normal equation, $9.8\Delta t - 0.401a_w + 1.359a_e + 1.301c + 10.703 = 0$

Normal equation, $1 \quad -0.041 \quad +0.139 \quad +0.133 \; + \; 1.092 = 0$

Adopted $a_w = -0^s.30 \qquad a_e = -0^s.13 \qquad c = +0^s.25$

Chronometer fast $7^s.12$ at $16^h.88$.

[Saint Louis, Mo., July 24, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ϐ Ophiuchi	E.	1.0	+0.56	−1.00	17	37	57.67	+.01
μ Herculis		1.0	+ .21	1.13		42	07.63	+.18
ψ Draconis		0.5	−1.81	3.27		44	09.61	.00
χ Ophiuchi	E.	1.0	+ .76	−1.01		52	52.16	−.03
γ Draconis	W.	0.8	−0.36	+1.61		54	05.06	−.22
72 Ophiuchi		1.0	+ .49	1.01	18	02	03.49	+.02
ο Herculis		1.0	+ .20	1.14		03	12.85	+.03
μ Sagittarii		1.0	+ .93	1.07		07	03.24	−.08
η Serpentis		1.0	+ .66	1.00		15	31.31	−.05
109 Herculis	W.	1.0	+ .31	+1.08		18	57.51	+.09

Normal equation, $9.3\Delta t + 0.625a_e + 2.302a_w + 1.813c + 9.556 = 0$

Normal equation, $1 \quad +0.067 \quad +0.248 \quad +0.195 \; +1.0275 = 0$

Adopted $a_w = -0^s.14 \qquad a_e = -0^s.14 \qquad c = +0^s.28$

Chronometer fast $7^s.04$ at $17^h.98$.

TABLE III—*Details of time work*—Continued.

[Saint Louis, Mo., July 26, 1885. Before signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ε Cor. Bor	E.	1.0	+0.22	−1.12	7	34	45.19	+.01
β Scorpii		1.0	+ .90	1.06		40	40.97	+.09
Gr. 2320		0.9	−1.32	2.68		47	51.96	−.02
δ Ophiuchi		1.0	+ .67	1.00		50	12.98	−.06
σ Cor. Bor	E.	1.0	+ .09	−1.21		52	14.91	+.02
19 Ursæ Minoris	W.	0.8	−2.55	+4.18		55	56 92	+.04
γ Herculis		1.0	+ .35	1.06		58	43.17	−.05
α Scorpii		1.0	+1.01	1.11	8	04	14.27	+.04
β Herculis		1.0	+ .31	1.08		07	07.55	−.01
σ Herculis	W.	1.0	− .10	+1.36		12	13.46	−.02

Normal equation, $9.7\Delta t+0.692a_e-0.470a_w+1.152c+19.902=0$

Normal equation, $1 \quad +0.071 \quad -0.048 \quad +0.119+2.052=0$

Adopted $a_w=-0^s.64$ $a_e=-0^s.53$ $c=-0^s.18$

Clock fast $1^m\ 30^s.02$ at $7^h.90$.

[Saint Louis, Mo., July 26, 1885. After signals. Observer, Pritchett.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	8	33	00.37	−.05
ε Ursæ Minoris		0.6	−5.09	7.38		39	29.41	−.14
α Herculis		1.0	+ .42	1.03		51	08.32	−.01
δ Herculis		1.0	+ .26	1.10		52	02.16	−.08
π Herculis	W.	1.0	+ .04	+1.25		52	46.00	+.10
α Ophiuchi	E.	1.0	+0.45	−1.02	9	11	16.46	+.03
β Ophiuchi		1.0	+ .56	1.00		19	27.05	+.06
μ Herculis		1.0	+ .21	1.13		23	35.84	.00
ξ Draconis		1.0	− .57	1.83		33	08.79	+.07
γ Draconis	E.	1.0	− .36	−1.61		35	31.99	−.05

Normal equation, $9.6\Delta t-1.844a_w+0.290a_e+2.228c+27.712=0$

Normal equation, $1 \quad -0.192 \quad +0.030 \quad +0.232+2.887=0$

Adopted $a_w=-0^s.68$ $a_e=-0^s.74$ $c=-0^s.15$

Clock fast $1^m\ 29^s.96$ at $8^h.77$.

TABLE III.—*Details of time work*—Continued.

[Saint Louis, Mo., July 26, 1885. Before signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
ζ Ursæ Minoris	E.	0.3	−3.10	−4.87	15	48	13.87	+.23
ε Cor. Bor		1.0	+ .22	1.12		52	54.93	+.14
θ Draconis		0.8	− .67	1.93		59	48.62	−.07
δ Ophiuchi		1.0	+ .67	1.00	16	08	24.93	−.10
ε Ophiuchi	E.	1.0	+ .68	−1.00		12	20.06	−.06
η Draconis	W.	0.7	−0.83	+2.11	16	22	30.42	−.15
β Herculis		1.0	+ .31	1.08		25	21.91	+.08
A Draconis		0.6	−1.41	2.79		28	16.63	+.12
ζ Ophiuchi		1.0	+ .77	1.02		30	55.52	−.01
Gr. 2377	W.	0.8	− .58	+1.84		43	11.70	−.05

Normal equation, $8.2t+\Delta 0.104a_e-0.811a_w+0.598c+0.734=0$

Normal equation, $1 \quad +0.013 \quad -0.099 \quad +0.073 \quad +0.0895=0$

Adopted $a_w=-0^s.24 \qquad a_e=-0^s.24 \qquad c=+0^s.10$

Chronometer fast $3^s.12$ at $16^h.27$.

[Saint Louis, Mo., July 26, 1885. After signals. Observer, Woodward.]

Name of star.	Clamp.	Weight.	*A*	*C*	*t*			*v*
					h.	*m.*	*s.*	*s.*
κ Ophiuchi	W.	1.0	+0.49	+1.01	16	52	18.99	−.01
ε Herculis		1.0	+ .15	1.17		55	58.63	+.07
η Ophiuchi		1.0	+ .84	1.04	17	03	52.97	−.06
ζ Draconis		0.6	−1.12	2.44		08	31.76	−.02
δ Herculis	W.	1.0	+ .26	+1.10		10	23.77	−.05
β Draconis	E.	0.8	−0.39	−1.64	17	27	55.75	−.11
α Ophiuchi		1.0	+ .45	1.02		29	41.74	+.02
β Ophiuchi		1.0	+ .56	1.00		37	53.51	−.04
μ Herculis		1.0	+ .21	1.13		42	03.42	+.04
γ Draconis	E.	0.8	− .36	−1.61		54	02.26	+.13

Normal equation, $9.2\Delta t+1.068a_w+0.620a_e+0.034c+1.124=0$

Normal equation, $1 \quad +0.116 \quad +0.067 \quad +0.004 \quad +0.1222=0$

Adopted $a_w=-0^s.23 \qquad a_e=0^s.00 \qquad c=+0^s.20$

Chronometer fast $3^s.10$ at $17^h.33$.

(13) *Time-piece corrections and rates.*—Collecting the clock corrections and their epochs from the preceding tables, and deriving the hourly rates of the time-pieces from equation (7) of section (9), we have the following Table IV:

TABLE IV.—*Time-piece corrections, epochs, rates, etc.*

Station.	Date.	Chronometer correction.	Epoch.	Hourly rate of time-piece.	Chronometer by Bond & Sons.
	1884.	*m.* *s.*	*h.*	*s.*	
Oswego, Kans	August 29	−0 22.72	18.02	+0.057	No. 187
		−0 22.58	20.49		
	30	−0 20.76	18.06	+0.073	187
		−0 20.58	20.52		
	31	−0 18.86	18.19	+0.066	187
		−0 18.71	20.47		
	September 1	−0 17.12	18.06	+0.083	187
		−0 16.92	20.48		
	2	−0 14.79	18.11	−0.081	187
		−0 14.98	20.47		
Elk Falls, Kans	25	−3 49.18	20.06	+0.052	187
		−3 49.06	22.36		
	28	−3 44.69	20.13	+0.034	187
		−3 44.62	22.16		
	October 2	−3 37.55	20.95	+0.103	187
		−3 37.37	22.70		
	6	−3 28.25	20.21	+0.042	187
		−3 28.15	22.62		
Fort Scott, Kans	17	+2 53.86	20.78	+0.055	187
		+2 53.99	23.16		
	18	+2 56.16	20.75	+0.077	187
		+2 56.33	22.94		
	19	+2 58.47	20.75	+0.125	187
		+2 58.72	22.74		
	22	+3 05.58	21.11	+0.108	187
		+3 05.83	23.42		
	23	+3 08.94	21.02	+0.107	187
		+3 09.18	23.25		
Springfield, Mo	November 13	−0 15.17	22.82	+0.067	187
		−0 15.08	24.16		
	14	−0 11.31	22.82	+0.091	187
		−0 11.20	24.03		
	15	−0 07.61	22.71	+0.077	187
		−0 07.48	24.39		
	16	−0 04.58	22.81	+0.082	187
		−0 04.48	24.03		

TABLE IV.—*Time-piece corrections, epochs, rates, etc.*—Continued.

Station.	Date.	Chronometer correction.	Epoch.	Hourly rate of time-piece.	Chronometer by Bond & Sons.
	1884.	*m.* *s.*	*h.*	*s.*	
Bolivar, Mo	December 15	+1 32.21	2.10	+0.258	187
		+1 32.58	3.53		
	18	+1 46.61	0.94	+0.342	187
		+1 47.13	2.46		
	1885.				
Saint Louis, Mo	June 10	−0 31.73	14.12	−0.042	187
		−0 31.80	15.79		
	12	−0 30.28	14.06	+0.123	187
		−0 30.10	15.53		
	14	−0 27.97	15.32	+0.083	187
		−0 27.87	16.52		
Albuquerque, N. Mex	July 2	−0 07.56	14.73	−0.073	187
		−0 07.71	16.79		
	6	−0 07.11	14.84	+0.006	187
		−0 07.10	16.58		
	7	−0 06.88	14.77	−0.017	187
		−0 06.91	16.58		
	8	−0 06.32	14.91	+0.005	187
		−0 06.31	17.11		
	14	−0 03.93	15.48	+0.034	187
		−0 03.89	16.67		
	15	−0 03.85	15.69	+0.088	187
		−0 03.77	16.60		
	19	−0 02.70	15.45	+0.025	187
		−0 02.67	16.63		
Saint Louis, Mo	24	−0 07.12	16.88	+0.073	187
		−0 07.04	17.98		
	26	−0 03.12	16.27	+0.019	187
		−0 03.10	17.33		

TABLE IV.—*Time-piece corrections, epochs, rates, etc.*—Continued.

Station.	Date.		Clock correction.	Epoch.	Hourly rate of time-piece.	Clock by Howard.
	1884.		*m.* *s.*	*h.*	*s.*	
Saint Louis, Mo	August	29	—0 49.96	8.33	—0.026	No. 225
			—0 50.00	9.90		
		30	—0 49.59	8.42	0.000	225
			—0 49.59	9.83		
		31	—0 49.05	8.39	—0.038	225
			—0 49.10	9.73		
	September	1	—0 49.25	8.32	+0.053	225
			—0 49.18	9.66		
		2	—0 49.00	8.24	+0.052	225
			—0 48.93	9.60		
		25	—0 49.24	8.44	+0.071	225
			—0 49.13	10.02		
		28	—0 49.49	8.22	+0.171	225
			—0 49.24	9.68		
	October	2	—0 48.05	8.35	—0.041	225
			—0 48.12	10.07		
		6	—0 49.15	8.10	—0.024	225
			—0 49.18	9.34		
		17	—1 12.24	8.55	—0.009	214
			—1 12.25	9.58		
		18	—1 13.23	8.07	—0.140	214
			—1 13.37	9.07		
		19	—1 13.66	8.03	+0.073	214
			—1 13.59	8.99		
		22	—1 12.44	7.86	—0.010	214
			—1 12.45	8.88		
		23	—1 12.30	7.79	+0.108	214
			—1 12.20	8.72		
	November	13	—1 03.77	7.54	+0.019	214
			—1 03.74	9.14		
		14	—0 48.88	7.37	+0.099	225
			—0 48.74	8.78		
		15	—0 48.90	7.26	+0.029	225
			—0 48.86	8.66		
		16	—0 48.08	7.23	+0.056	225
			—0 48.00	8.65		
	December	15	—0 03.20	9.01	+0.187	214
			—0 03.07	9.96		
		18	—0 51.24	7.95	—0.009	225
			—0 51.25	9.12		

TABLE IV.—*Time-piece, corrections, epochs, rates, etc.*—Continued.

Stations.	Date.		Clock corrections.	Epoch.	Hourly rate of time-piece.	Clock by Howard.
	1885.		m. s.	h.	s.	
Saint Louis, Mo.	June	10	−0 50.36	8.88	−0.217	225
			−0 50.70	10.45		
		12	−0 45.67	8.71	−0.008	214
			−0 45.68	9.92		
		14	−0 47.32	9.95	−0.060	214
			−0 47.39	11.11		
	July	2	−1 04.20	9.19	−0.034	214
			−1 04.25	10.68		
		6	−1 08.45	8.93	−0.117	214
			−1 08.59	10.13		
		7	−1 09.49	8.87	−0.033	214
			−1 09.54	10.38		
		8	−1 10.38	8.80	−0.073	214
			−1 10.49	10.31		
		14	−1 17.27	8.85	−0.061	214
			−1 17.39	10.82		
		15	−1 18.33	8.50	−0.047	214
			−1 18.40	10.00		
		19	−1 22.72	8.41	+0.011	214
			−1 22.70	10.21		
		24	−1 27.59	8.76	−0.082	214
			−1 27.69	9.98		
		26	−1 30.02	7.90	+0.069	214
			−1 29.96	8.77		

(14) *Apparent differences of longitude.*—In comparing time-pieces the signals were transmitted automatically, that is, the clock at the eastern station was made to break the circuit of the telegraph line, which in turn broke the chronograph circuit at the western station, thus giving a comparison of the time-pieces on the chronograph at the western station. Then, by reversing the operation, a comparison was secured on the chronograph at the eastern station.

From the data given in the last table therefore the apparent differences of longitude between the field stations and Saint Louis, resulting from the signals sent from east to west or from west to east, may now be derived. Table V gives these differences, together with the principal quantities on which they depend. The differences of longitude from the personal equation work of 1885 are given in Table VI.

TABLE V.—*Apparent differences of longitude.*

[Results for differences from signals received at field station.]

Field station.	Date.		Saint Louis clock time of signal.			Clock correction.	Saint Louis mean time of signal.			Field chronometer time of signal.			Chronometer correction.		Saint Louis sidereal time of signal.			Field sidereal time of signal.			Field station west of Saint Louis.		
	1884.		*h.*	*m.*	*s.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*	*h.*	*m.*	*s.*
Oswego, Kans.	August	29	9	05	00.00	—49.98	9	04	10.02	19	19	48.30	—0	22.65	19	39	01.72	19	19	25.65	00	19	36.07
		30	9	06	00.00	—49.59	9	05	10.41	19	24	43.46	—0	20.66	19	43	58.83	19	24	22.80	00	19	36.03
		31	8	59	00.00	—49.07	8	58	10.93	19	21	37.47	—0	18.78	19	40	54.75	19	21	18.69	00	19	36.06
	September	1	9	00	00.00	—49.21	8	59	10.79	19	26	32.26	—0	17.01	19	45	51.32	19	26	15.25	00	19	36.07
		2	9	02	00.00	—48.96	9	01	11.04	19	32	27.23	—0	14.91	19	51	48.46	19	32	12.32	00	19	36.14
Elk Falls, Kans.		25	9	25	48.00	—49.17	9	24	58.83	21	26	14.71	—3	49.11	21	46	20.86	21	22	25.60	00	23	55.26
		28	8	50	10.00	—49.39	8	49	20.61	21	02	15.65	—3	44.66	21	22	26.44	20	58	30.99	00	23	55.45
	October	2	9	21	10.00	—48.09	9	20	21.91	21	49	01.15	—3	37.46	22	09	19.04	21	45	23.69	00	23	55.35
		6	8	49	10.00	—49.17	8	48	20.83	21	32	31.62	—3	28.19	21	52	58.91	21	29	03.43	00	23	55.48
Fort Scott, Kans.		17	9	01	05.00	—72.24	8	50	52.76	22	27	00.60	+2	53.95	22	47	54.81	22	29	54.55	00	18	00.26
		18	8	34	05.00	—73.30	8	32	56.70	22	03	49.32	+2	56.26	22	24	45.87	22	06	45.58	00	18	00.29
		19	8	30	23.00	—73.63	8	29	09.37	22	04	00.63	+2	58 64	22	24	59.48	22	06	59.27	00	18	00.21
		22	8	44	00.00	—72.45	8	42	47.55	22	29	23.63	+3	05.73	22	50	29.56	22	32	29.36	00	18	00.20
		23	8	28	35.00	—72.23	8	27	22.77	22	17	49.45	+3	09.08	22	38	58.80	22	20	58.53	00	18	00.27
Springfield, Mo.	November	13	8	05	00.00	—63.76	8	03	56.24	23	26	11.44	—0	15.13	23	38	16.05	23	25	56.31	00	12	19.74
		14	8	00	00.00	—48.82	7	59	11.18	23	25	18.46	—0	11.26	23	37	26.76	23	25	07.20	00	12	19.56
		15	7	54	20.00	—48.88	7	53	31.12	23	23	30.31	—0	07.56	23	35	42.33	23	23	22.75	00	12	19.58
		16	7	53	10.00	—48.04	7	52	21.96	23	26	14.43	—0	04.53	23	38	29.53	23	26	09.90	00	12	19.63
Bolivar, Mo.	December	15	9	25	03.00	—03.14	9	24	59.86	02	51	20.66	+1	32.40	03	05	42.78	02	52	53.06	00	12	49.72
		18	8	27	00.00	—51.24	8	26	08.76	02	03	55.08	+1	47.00	02	18	31.68	02	05	42.08	00	12	49.60
	1885.																						
Albuquerque, N. Mex.	July	2	9	59	30.00	—64.23	9	58	25.77	15	38	09.03	—0	07.63	16	43	48.57	15	38	01.40	1	05	47.17
		6	9	44	13.00	—68.54	9	43	04.46	15	38	30.80	—0	07.11	16	44	10.94	15	38	23.69	1	05	47.25
		7	9	36	08.00	—69.51	9	34	58.49	15	34	19.77	—0	06.89	16	40	00.20	15	34	12.88	1	05	47.32
		8	9	38	30.00	—70.44	9	37	19.56	15	40	37.20	—0	06.32	16	46	18.22	15	40	30.88	1	05	47.34
		14	9	31	32.00	—77.31	9	30	14.69	15	57	08.22	—0	03.91	17	02	51.52	15	57	04.31	1	05	47.21
		15	9	20	30.00	—78.37	9	19	11.63	15	49	59.71	—0	03.83	16	55	43.20	15	49	55.88	1	05	47.32
		19	9	21	30.00	—82.71	9	20	07.29	16	06	40.71	—0	02.68	17	12	25.24	16	06	38.03	1	05	47.21

TABLE V.—*Apparent differences of longitude*—Continued.

[Results for differences from signals received at Saint Louis.]

Field station.	Date.	Saint Louis clock time of signal.	Clock corrections.	Saint Louis mean time of signal.	Field chronometer time of signal.	Chronometer correction.	Saint Louis sidereal time of signal.	Field sidereal time of signal.	Station west of Saint Louis.
	1884.	h. m. s.	s.	h. m. s.	h. m. s.	m. s.	h. m. s.	h. m. s.	h. m. s.
Oswego, Kans	August 29	9 09 11.21	—49.98	9 08 21.23	19 24 00.00	—0 22.64	19 43 13.62	19 23 37.36	00 19 36.26
	30	9 13 15.55	—49.59	9 12 25.96	19 32 00.00	—0 20.66	19 51 15.57	19 31 39.34	00 19 36.23
	31	9 01 22.35	—49.07	9 00 33.28	19 24 00.00	—0 18.78	19 43 17.49	19 23 41.22	00 19 36.27
	September 1	9 03 27.39	—49.21	9 02 38.18	19 30 00.00	—0 17.00	19 49 19.28	19 29 43.00	00 19 36.28
	2	9 06 32.24	—48.96	9 05 43.28	19 37 00.00	—0 14.91	19 56 21.45	19 36 45.09	00 19 36.36
Elk Falls, Kans	25	9 29 42.82	—49.17	9 28 53.65	21 30 10.00	—3 49.10	21 50 16.33	21 26 20.90	00 23 55.43
	28	8 55 03.72	—49.37	8 54 14.35	21 07 10.00	—3 44.66	21 27 20.98	21 03 25.34	00 23 55.64
	October 2	9 30 17.54	—48.09	9 29 29.45	21 58 10.00	—3 37.45	22 18 28.08	21 54 32.55	00 23 55.53
	6	8 57 37.20	—49.17	8 56 48.03	21 41 00.00	—3 28.19	22 01 27.50	21 37 31.81	00 23 55.69
Fort Scott, Kans	17	9 05 13.85	—72.24	9 04 01.61	22 31 10.00	+2 53.96	22 52 04.34	22 34 03.96	00 18 00.38
	18	8 36 25.39	—73.30	8 35 12.09	22 06 10.00	+2 56.26	22 27 06.64	22 09 06.26	00 18 00.38
	19	8 36 41.40	—73.62	8 35 27.78	22 10 20.00	+2 58.64	22 31 18.93	22 13 18.64	00 18 00.29
	22	8 48 35.70	—72.45	8 47 23.25	22 34 00.00	+3 05.74	22 55 06.02	22 37 05.74	00 18 00.28
	23	8 48 32.39	—72.19	8 47 20.20	22 37 50.00	+3 09.11	22 58 59.51	22 40 59.11	00 18 00.40
Springfield, Mo.........	November 13	8 11 47.56	—63.76	8 10 43.80	23 33 00.00	—0 15.12	23 45 04.72	23 32 44.88	00 12 19.84
	14	8 02 51.18	—48.81	8 02 02.37	23 28 10.00	—0 11.25	23 40 18.42	23 27 58.75	00 12 19.67
	15	8 02 08.51	—48.88	8 01 19.63	23 31 20.00	—0 07.55	23 43 32.12	23 31 12.45	00 12 19.67
	16	7 55 15.33	—48.04	7 54 27.29	23 28 20.00	—0 04.53	23 40 35.20	23 28 15.47	00 12 19.73
Bolivar, Mo	December 15	9 31 01.46	—03.13	9 30 58.33	02 57 20.00	+1 32.43	03 11 42.24	02 58 52.43	00 12 49.81
	18	8 37 23.23	—51.25	8 36 32.08	02 14 20.00	+1 47.05	02 28 56.70	02 16 07.05	00 12 49.65
	1885.								
Albuquerque, N. Mex ..	July 2	10 09 47.48	—64.23	10 08 43.25	15 48 28.00	—0 07.64	16 54 07.73	15 48 20.36	1 05 47.37
	6	10 01 07.60	—68.57	9 59 59.03	15 55 28.00	—0 07.10	17 01 08.29	15 55 20.90	1 05 47.39
	7	9 42 37.33	—69.52	9 41 27.81	15 40 50.00	—0 06.89	16 46 30.59	15 40 43.11	1 05 47.48
	8	9 46 27.64	—70.45	9 45 17.19	15 48 36.00	—0 06.31	16 54 17.16	15 48 29.09	1 05 47.47
	14	9 35 51.22	—77.32	9 34 33.90	16 01 28.00	—0 03.91	17 07 11.45	16 01 24.09	1 05 47.36
	15	9 24 59.72	—78.37	9 23 41.35	15 54 30.00	—0 03.83	17 00 13.66	15 54 26.17	1 05 47.49
	19	9 24 18.97	—82.71	9 22 56.26	16 09 30.00	—0 02.68	17 15 14.67	16 09 27.32	1 05 47.35

TABLE VI.—*Apparent differences of longitude. Personal equation work at Saint Louis.*

[From record of Geological Survey chronograph.]

Date.	Saint Louis clock time of signal.	Clock correction.	Saint Louis mean time of signal.	Survey chronometer time of signal.	Chronometer correction.	Saint Louis sidereal time of signal. Pritchett.	Saint Louis sidereal time of signal. Woodward.	Pritchett's time minus Woodward's time.
1885.	*h. m. s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
June 10	9 32 30.00	—50.50	9 31 39.50	14 50 45.58	—31.76	14 50 13.63	14 50 13.82	—0.19
10	11 07 30.00	—50.85	11 06 39.15	16 26 01.16	—31.83	16 25 28.88	16 25 29.33	—0.45
12	9 16 30.00	—45.67	9 15 44.33	14 42 39.46	—30.20	14 42 08.96	14 42 09.26	—0.30
12	9 17 16.00	—45.68	9 16 30.32	14 43 25.58	—30.20	14 42 55.08	14 42 55.38	—0.30
14	9 55 30.00	—47.32	9 54 42.68	15 29 35.04	—27.96	15 29 06.83	15 29 07.08	—0.25
14	10 30 30.00	—47.35	10 29 42.65	16 04 40.75	—27.91	16 04 12.55	16 04 12.84	—0.29
14	11 31 30.00	—47.41	11 30 42.59	17 05 50.69	—27.82	17 05 22.51	17 05 22.87	—0.36

[From record of Professor Pritchett's chronograph.]

Date.	Saint Louis clock time of signal.	Clock correction.	Saint Louis mean time of signal.	Survey chronometer time of signal.	Chronometer correction.	Saint Louis sidereal time of signal. Pritchett.	Saint Louis sidereal time of signal. Woodward.	Pritchett's time minus Woodward's time.
1885.								
June 10	9 38 51.39	—50.53	9 38 00.86	14 57 08.00	—31.76	14 56 36.03	14 56 36.24	—0.21
10	11 04 33.36	—50.84	11 03 42.52	16 23 04.00	—31.82	16 22 31.77	16 22 32.18	—0.41
12	9 23 49.37	—45.68	9 23 03.69	14 50 00.00	—30.19	14 49 29.53	14 49 29.81	—0.28
14	9 57 34.62	—47.32	9 56 47.30	15 31 40.00	—27.95	15 31 11.79	15 31 12.05	—0.26
14	10 28 19.61	—47.35	10 27 32.26	16 02 30.00	—27.91	16 02 01.80	16 02 02.09	—0.29
14	11 29 39.61	—47.41	11 28 52.20	17 04 00.00	—27.82	17 03 31.81	17 03 32.18	—0.37

[From record of Geological Survey chronograph.]

Date.	Saint Louis clock time of signal.	Clock correction.	Saint Louis mean time of signal.	Survey chronometer time of signal.	Chronometer correction.	Saint Louis sidereal time of signal. Pritchett.	Saint Louis sidereal time of signal. Woodward.	Pritchett's time minus Woodward's time.
1885.								
July 24	8 39 39.00	—87.58	8 38 02.42	16 50 03.68	—07.12	16 49 56.23	16 49 56.56	—0.33
24	9 21 30.00	—87.64	9 20 02.36	17 32 10.46	—07.07	17 32 03.07	17 32 03.39	—0.32
24	10 18 30.00	—87.72	10 17 02.28	18 29 19.69	—07.00	18 29 12.35	18 29 12.69	—0.34
26	7 57 30.00	—90.02	7 55 59.96	16 15 43.66	—03.12	16 15 39.99	16 15 40.54	—0.55
26	8 31 30.00	—89.98	8 30 00.02	16 49 49.18	—03.11	16 49 45.62	16 49 46.07	—0.45
26	8 55 30.00	—89.95	8 54 00.05	17 13 53.07	—03.10	17 13 49.59	17 13 49.97	—0.38

[From record of Professor Pritchett's chronograph.]

1885.								
July 24	8 43 25.70	—87.59	8 41 58.11	16 54 00.00	—07.12	16 53 52.57	16 53 52.88	—0.31
24	9 23 23.23	—87.64	9 21 55.59	17 34 04.00	—07.07	17 33 56.61	17 33 56.93	—0.32
24	10 23 25.52	—87.72	10 21 57.80	18 34 16.00	—07.00	18 34 08.68	18 34 09.00	—0.32
26	8 01 23.71	—90.01	7 59 53.70	16 19 38.00	—03.12	16 19 34.36	16 19 34.88	—0.52
26	8 29 53.09	—89.98	8 28 23.11	16 48 12.00	—03.11	16 48 08.44	16 48 08.89	—0.45
26	8 54 07.17	—89.95	8 52 37.22	17 12 30.00	—03.10	17 12 26.54	17 12 26.90	—0.36

(15) *Relations of apparent and true differences of longitude and systematic errors.*—In order to show the relations of the results in the last column of the two preceding tables to the true difference of longitude and to the systematic errors which may affect that difference, let—

T_e = the eastern clock time of a signal sent to the western station,
T_w = the western clock time of receiving that signal;
T_w' = the western clock time of a signal sent to the eastern station,
T_e' = the eastern clock time of receiving that signal;
x_e, x_w = the total retardations in transmission of a signal from the eastern to the western and from the western to the eastern station, respectively;
y_e, y_w = the total retardations in transmission of signals from the observers to their chronographs at the eastern and western stations, respectively;
P_e, P_w = the absolute personal equations of the eastern and western observers, respectively;
$\Delta t_e', \Delta t_w, \Delta t_e', \Delta t_w'$ = the apparent clock corrections corresponding to T_e, T_w, T_e', T_w', respectively;
$\Delta\lambda$ = the true difference of longitude.

Then the clock corrections affected by accidental errors only are, respectively:

$$\begin{aligned}&\Delta t_e\ -P_e\ -y_e,\\&\Delta t_w\ -P_w-y_w,\\&\Delta t_e'-P_e\ -y_e,\\&\Delta t_w'-P_w-y_w.\end{aligned}$$

The corrected clock times of sending and receiving signals are, respectively:

$$\begin{aligned}&T_e-\Delta t_e+P_e+y_e,\\&T_w-\Delta t_w+P_w+y_w,\\&T_e'-\Delta t_e'+P_e+y_e,\\&T_w'-\Delta t_w'+P_w+y_w.\end{aligned}$$

Now, from the signals sent from the eastern to the western station,

$$\Delta\lambda+T_w-\Delta t_w+P_w+y_w=T_e-\Delta t_e+P_e+y_e+x_e \qquad (9)$$

And from the signals sent from the western to the eastern station,

$$\Delta\lambda+T_w'-\Delta t_w'+P_w+y_w+x_w=T_e'-\Delta t_e'+P_e+y_e. \qquad (10)$$

For brevity put

$$\left.\begin{aligned}\Delta\lambda_1&=(T_e\ -\Delta t_e\ )-(T_w\ -\Delta t_w\ ),\\\Delta\lambda_2&=(T_e'-\Delta t_e')-(T_w'-\Delta t_w').\end{aligned}\right\} \qquad (11)$$

Then equations (9) and (10) give

$$\Delta\lambda = \tfrac{1}{2}(\Delta\lambda_2 + \Delta\lambda_1) + (P_e - P_w) + (y_e - y_w) + \tfrac{1}{2}(x_e - x_w). \tag{12}$$

$$\tfrac{1}{2}(x_e + x_w) = \tfrac{1}{2}(\Delta\lambda_2 - \Delta\lambda_1). \tag{13}$$

(16) *Derivation of longitude differences uncorrected for personal and instrumental equation.*—The values of $\Delta\lambda_1$ and $\Delta\lambda_2$ are given in the final columns of Tables V. These values and their half sums and half differences for the several stations and dates are collected in the following table:

TABLE VII.—*Approximate results for longitude differences and transmission times.*

Name of station.	Date.	$\Delta\lambda_1$	$\Delta\lambda_2$	$\frac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)$	$\frac{1}{2}(\Delta\lambda_2-\Delta\lambda_1)$
	1884.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*
Oswego, Kans.	Aug. 29	0 19 36.26	0 19 36.07	0 19 36.16	+0.095
	30	.23	.03	.13	.100
	31	.27	.06	.16	.105
	Sept. 1	.28	.07	.17	.105
	2	.36	.14	.25	.110
Mean				0 19 36.180	
Elk Falls, Kans.	Sept. 25	0 23 55.43	0 23 55.26	0 23 55.34	0.085
	28	.64	.45	.54	.095
	Oct. 2	.53	.35	.44	.090
	6	.69	.48	.58	.105
Mean				0 23 55.475	
Fort Scott, Kans.	Oct. 17	0 18 00.38	0 18 00.26	0 18 00.32	0.060
	18	.38	.29	.33	.045
	19	.29	.21	.25	.040
	22	.28	.20	.24	.040
	23	.40	.27	.33	.065
Mean				0 18 00.294	
Springfield, Mo.	Nov. 13	0 12 19.84	0 12 19.74	0 12 19.79	0.050
	14	.67	.56	.61	.055
	15	.67	.58	.62	.045
	16	.73	.63	.68	.050
Mean				0 12 19.675	
Bolivar, Mo.	Dec. 15	0 12 49.81	0 12 49.72	0 12 49.76	0.045
	18	.65	.60	.62	.025
Mean				0 12 49.690	
Albuquerque, N. Mex.	July 2	1 05 47.37	1 05 47.17	1 05 47.27	0.100
	6	.39	.25	.32	.070
	7	.48	.32	.40	.080
	8	.47	.34	.41	.065
	14	.36	.21	.28	.075
	15	.49	.32	.40	.085
	19	.35	.21	.28	.070
Mean				1 05 47.337	

If now we denote by Δl the most probable value of $\frac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)$ for any station, *i. e.*, the most probable value of the longitude uncorrected for personal equation and armature and wave time, we shall have for any difference of longitude a series of observation equations of the form

$$\Delta l-\tfrac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)=v. \qquad (14)$$

Denoting the values of Δl for the several stations by the suffixes 1, 2, . . . 6, we get from the last table the following series of observation equations:

Observation equations for the quantities Δl.

Station.	Date.		Equations.			Residual.	Weight.
	1884.		h.	m.	s.	s.	
Oswego	Aug.	29	$1\Delta l_1 - 0$	19	36.16	+0.01	1
		30	1 —		.13	−0.03	1
		31	1 —		.16	+0.01	1
	Sept.	1	1 —		.17	+0.01	1
Elk Falls	Sept.	25	$1\Delta l_2 - 0$	23	55.34	−0.13	1
		28	1 —		.54	+0.06	1
	Oct.	2	1 —		.44	−0.03	1
		6	1 —		.58	+0.10	1
Fort Scott	Oct.	17	$1\Delta l_3 - 0$	18	00.32	+0.03	1
		18	1 —		.33	+0.04	1
		19	1 —		.25	−0.04	1
		22	1 —		.24	−0.05	1
		23	1 —		.33	+0.04	1
Springfield	Nov.	13	$1\Delta l_4 - 0$	12	19.79	+0.11	1
		14	1 —		.61	−0.07	1
		15	1 —		.62	−0.06	0.5
		16	1 —		.68	−0.00	1
Bolivar	Dec.	15	$1\Delta l_5 - 0$	12	49.76	+0.07	0.5
		18	1 —		.62	−0.07	0.5
Albuquerque	1885. July	2	$1\Delta l_6 - 1$	05	47.27	−0.07	1
		6	1 —		.32	−0.02	1
		7	1 —		.40	+0.06	1
		8	1 —		.41	+0.07	1
		14	1 —		.28	−0.05	1
		15	1 —		.40	+0.06	1
		19	1 —		.28	−0.06	1

The observation equations in the above table have been given equal weights, with three exceptions.

The equation for November 15, 1884, has been given half weight, for the reason that the first time determination at Springfield on that date was imperfect, owing to partial cloudiness.

Half weight has been assigned to the equation for December 15, 1884, because of unusually bad seeing, which was recorded both at Saint Louis and at Bolivar. The equation for December 18, 1884, is given half weight on account of unfavorable conditions at Bolivar. During the afternoon and evening of December 18 the temperature fell rapidly, reaching −5° F. about the time of the exchange of signals. As a result of this change in temperature the inclination of the horizontal axis of the transit instrument underwent a progressive change of considerable amount. Care was taken to read the striding level for every star observed, but the deduced level corrections were less precise than usual. The Bond & Sons chronometer used in the chronograph circuit behaved fairly well, apparently, but the Blunt & Nichols chronometer, exposed to a free circulation of the air, froze up and stopped. The chronographic record was also somewhat less perfect than usual, it being necessary to use a pencil instead of a pen, as the ink for the latter froze.

The result for September 2, 1884, in Table VII, has not been used, for the reason that the observations at Saint Louis on that date were made by Mr. Ramel, whose personal equation relative to the writer has not been determined.

Forming and solving the normal equations, and computing the probable errors, there result—

	h.	m.	s.	s.
$\Delta l_1=$	0	19	36.155	$\pm$0.022
$\Delta l_2=$	0	23	55.475	$\pm$0.022
$\Delta l_3=$	0	18	00.294	$\pm$0.020
$\Delta l_4=$	0	12	19.683	$\pm$0.024
$\Delta l_5=$	0	12	49.690	$\pm$0.045
$\Delta l_6=$	1	5	47.337	$\pm$0.017

(17) *Corrections for personal equation.*—It remains now to correct the results just derived for personal and instrumental equation, or for the last three terms of the second member of equation (12).

As already stated in section 12 the observations for personal equation in 1884 were all made at Saint Louis, both observers using the same instrument (Professor Pritchett's). This method of determining personal equation is not a good one. It is inadequate to determine personal equation proper unless the transits habitually used by the observers are precisely alike and gives no clue in any case to the magnitude of the quantity (y_e-y_w) of equation (12). However, as the primary object of the longitude work of 1884 was the fixation of positions within the limits of probable plumb-line defections, the method adopted for determining personal equation was thought sufficient.

Referring to pages 84 to 87 of the time work we have the following results for relative personal equation, *i. e.*, for P_e-P_w of equation (12):

			s.
1884. August	12,	$P_e-P_w =$	+ 0.01,
	13,	=	+ 0.05,
December	22,	=	+ 0.16,
	23,	=	+ 0.23.

These results mean that Pritchett observes the transit of a star later than Woodward.

If these were the only data we possess concerning the relative personal and instrumental equation it would probably be best to apply the mean of the above results to each of the longitudes (Δl) determined in 1884. But the more complete observations made in 1885, when each observer used his own transit and apparatus, gave so much greater a value for the relative equation[1] that we believe they should have a controlling influence in deriving the correction to be applied to the longitudes of 1884.

The results obtained in the personal equation work of 1885 are given in the final column of Table VI. These results are the values of $\Delta\lambda_1$ and $\Delta\lambda_2$, as defined by equations (11). Pritchett's transit was west of Woodward's 129 inches, or $0^s.009$. On June 10, June 14, July 24, and July 26

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[1] A considerable part of this apparent change in personal equation is undoubtedly due to the fact that the transit key used habitually by me requires much less pressure to break the circuit than Professor Pritchett's key, which was used in the personal equation work of 1884. Through the courtesy of Prof. J. R. Eastman, U. S. Navy, who placed his personal equation machine at my disposal, experiments have been made to determine my absolute equation both with the small key habitually used and with a large key of the same form and about the same stiffness of spring as Professor Pritchett's key. The results of these experiments are given in the table below. An individual result is derived from the times of transit over five threads in combination with the times of the immediately succeeding transit in the opposite direction over the same threads. The values in the fourth and fifth columns are arithmetical means of the individual results in the corresponding horizontal lines, and the results in the last column are differences between the means of the results in the two preceding columns for the respective dates. The minus sign indicates that the observer is late in recording a transit. It may be added that in making the observations I was conscious of some difficulty in applying suitable pressure to the large key immediately after having observed with the small key. This may account for the tendency shown by the results for May, 1887, to observe earlier with the large key directly after using the small key than I did before using the small key.

Results for absolute personal equation.

Date.	Key.	Individual results.	Mean values.		Mean.
			Large key (1).	Small key (2).	(1)—(2).
1886.		*s. s. s. s. s. s.*	*s.*	*s.*	*s.*
Nov. 23	Large	—.112, —.112, —.106.	—0.110		—0.032
23	Small	—.088, —.094, —.071, —.059.		—0.078	
1887.					
May 28	Large	—.130, —.095, —.105, —.100, —.080, —.095.	—0.101		
28	Small	—.005, —.035, —.010, —.020, +.005, —.040.		—0.017	—0.064
28	Large	—.060, —.085, —.030, —.050, —.090.	—0.061		
29	Large	—.175, —.130, —.110, —.130, —.100, —.105.	—0.125		
29	Large	—.110, —.110, —.090, —.090.	—0.100		
29	Small	—.015, —.010, —.005, —.035, —.050.		—0.023	
29	Small	—.055, —.020, —.040, —.055, —.020.		—0.038	—0.055
29	Small	—.070, —.030, —.065, —.105.		—0.067	
29	Large	—.065, —.075, —.065, —.085, —.055, —.065.	—0.068		
29	Large	—.090, —.105, —.115, —.085.	—0.099		

the time-pieces were compared at two or more epochs, so that a result for personal equation for either of these dates depends on the epochs of comparison for the same date. The values of $\varDelta\lambda_1$, $\varDelta\lambda_2$, their half sum and half difference, together with the dates and epochs, *t*, of comparison, are collected in Table VIII.

TABLE VIII.—*Results of personal equation work of* 1885.

Date.	Local sidereal time of comparison *t*.	$\Delta\lambda_1$	$\Delta\lambda_2$	$\frac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)$	$\frac{1}{2}(\Delta\lambda_2-\Delta\lambda_1)$
1885.	*h.*	*s.*	*s.*	*s.*	*s.*
June 10	14.88	+0.21	+0.19	+0.200	−0.010
10	16.40	+0.41	+0.45	+0.430	+0.020
12	14.79	+0.28	+0.30	+0.290	+0.010
14	15.50	+0.26	+0.25	+0.255	−0.005
14	16.05	+0.29	+0.29	+0.290	+0.000
14	17.06	+0.37	+0.36	+0.365	−0.005
July 24	16.85	+0.31	+0.33	+0.320	+0.010
24	17.55	+0.32	+0.32	+0.320	+0.000
24	18.52	+0.32	+0.34	+0.330	+0.010
26	16.30	+0.52	+0.55	+0.535	+0.015
26	16.80	+0.45	+0.45	+0.450	+0.000
26	17.22	+0.36	+0.38	+0.370	+0.010

The results given in the fifth column of this table for the dates when more than one comparison of time-pieces was made show, with the exception of the results of July 24, that the rates of the time-pieces deduced from the observations differ considerably from their actual rates. The discordances must be attributed in part at least to changes in personal equation, and they show clearly the desirability of having more than a single comparison of time-pieces on any night in such work. The most striking changes are indicated in the results for June 10 and July 26. For reasons which will be assigned presently the results for June 10 are less trustworthy than those of the other dates; but it may be observed that the rate of the Saint Louis clock (see rate for June 10, Table IV, and comparisons in Table V) is about three times as great as would come from the Survey chronometer through the comparisons. The results for July 26 are likewise markedly discordant amongst themselves and with the results for other dates; but there is no adequate reason for assigning them anything less than full weight. It will be remarked, however, that the rate of the Saint Louis clock (see Table IV) has a sign opposite to that of its daily rate from June 12 to July 26 and to the sign of its rate deduced from the comparisons with the Survey chronometer.[1]

In order to derive the proper mean value of $\frac{1}{2}(\varDelta\lambda_2+\varDelta\lambda_1)$ for the dates when two or more clock comparisons were made, we must know the relative weights of the individual values. Referring to equation (7) it will be seen that the adopted correction to either time-piece at any time $\tau + t_0'$ is of the form—

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[1] It is proper to state in this connection that Professor Pritchett has kindly taken the trouble to verify our reduction of his observations of July 26.

$$\varDelta t_0' + m(\varDelta t_0'' - \varDelta t_0') = (1-m)\varDelta t_0' + m\varDelta t_0'', \tag{15}$$

in which

$$m = \frac{\tau}{t_0'' - t_0'} \text{ and } \tau = t - t_0'.$$

Assuming the probable errors of $\varDelta t_0'$ and $\varDelta t_0''$ equal, the weight of the above correction (15) is, if we assign unit weight to a single clock correction,

$$w = \frac{1}{1 - 2m + 2m^2}. \tag{16}$$

This weight applies to the correction for one time-piece only. But since any value of $\frac{1}{2}(\varDelta\lambda_2 + \varDelta\lambda_1)$ involves the difference of two such corrections and has a weight proportional to

$$[2 - 2(m+n) + 2(m^2 + n^2)]^{-1}$$

in which m and n are nearly equal, we may use (16) for computing the required weights.

The epochs t_0' and t_0'' are given in Table IV. Hence we derive the following table of weighted mean values, together with the data on which they depend:

Data for weights and weighted mean values of $\frac{1}{2}(\varDelta\lambda_2 + \varDelta\lambda_1)$.

Date.	$t_0'' - t_0'$	τ	m	w	Individual values.	Weighted mean values.	Weights of means.
1885.	*h.*	*h.*			*s.*	*s.*	
June 10		0.7	0.4	1.92	+0.200		
10	1.7	2.3	1.4	0.47	+0.430	+0.245	2.39
12	1.5	0.6	0.4	1.92	+0.290	+0.290	1.92
14		0.2	0.2	1.47	+0.255		
14		0.8	0.7	1.72	+0.290		
14	1.2	1.8	1.5	0.40	+0.365	+0.284	3.59
July 24		0.0	0.0	1.00	+0.320		
24		0.7	0.6	1.92	+0.320		
24	1.1	1.6	1.5	0.40	+0.330	+0.321	3.32
26		0.0	0.0	1.00	+0.535		
26		0.6	0.6	1.92	+0.450		
26	1.0	1.0	1.0	1.00	+0.370	+0.451	3.92

The mean value $0^s.245$ for June 10 is, for two reasons, entitled to less weight than that assigned to it in the above table. In the first place, the Survey transit had been mounted during the afternoon of June 10, and its foot plates were set in cement only a few minutes before beginning work. On this account the horizontal axis of the instrument had a less stable inclination than usual. The amount of the inclination was so great at the end of the first time determination that it was adjusted by the foot screws. This adjustment is the cause of the change of azimuth shown in the time work. In the second place, Professor Pritchett's clock (Howard No. 225) did not seem to work as well as usual. It apparently underwent a sudden change some time between the two time determinations. Suspecting its performance was untrustworthy, Professor Pritchett used his other clock (Howard No. 214) in the subsequent work. For these reasons we shall diminish the theoretical weight 2.39 of the table to 1.20 in deriving a value for the relative personal equation from the June observations.

Applying the weight just mentioned to the mean for June 10, and the tabular weights to the mean values for June 12, June 14, July 24 and 26, we find,

June 10–14, 1885, $\frac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)=+0.279$ with weight 6.71.
July 24–26, 1885, $\frac{1}{2}(\Delta\lambda_2+\Delta\lambda_1)=+0.391$ with weight 7.24.

The weights of these results are so nearly equal that we may assume them to be equal for all further purposes.

Referring now to equation (12) and introducing the above values of $\frac{1}{2}(\Delta\lambda^2+\Delta\lambda_1)$ we have

$$P_e-P_w+y_e-y_w+\tfrac{1}{2}(x_e-x_w)=\Delta\lambda-0^s.279,\text{ June 10–14, 1885.}$$
$$=\Delta\lambda-0^s.391,\text{ July 24–26, 1885.}$$

Here $\Delta\lambda=+0^s.009$, as stated above, and as Pritchett was west of Woodward for the personal equation work and east of him for the longitude work, the correction for personal and instrumental equation to the longitude is

$+0^s.270$, June 10–14, 1885,
$+0^s.382$, July 24–26, 1885.

These results, like those obtained in 1884, mean that Pritchett observes the transit of a star later than Woodward. The mean of these two results is

$$+0^s.326\pm0^s.038,$$

the probable error being derived from the discrepancies between the individual values and the mean. We shall use this mean value to correct the longitude difference of Saint Louis and Albuquerque, or Δl_8 in section 16.

Collecting now all the data obtained in 1884 and 1885 for relative personal and instrumental equation, taking means of the values for

August 12 and 13, 1884, and for December 22 and 23, 1884, and assigning mean dates, we have these results:

August	12.5,	1884,	$+0^{s}.030$,
December	22.5,	1884,	$+0^{s}.195$,
June	12. ,	1885,	$+0^{s}.270$,
July	25. ,	1885,	$+0^{s}.382$.

The difference between the results of 1884 or those of 1885 is not greater than may be attributed to accidental errors and to changes in the relative equation itself. But the considerable discrepancy between the results for the two years is probably due to an actual difference in Woodward's equation according as he uses his own or Pritchett's apparatus. Assuming this to be the case, let x be the relative equation when both observers use Pritchett's apparatus and y the increase in the equation when each observer uses his own apparatus. Then the above results give the following system of loosely-connected observation equations:

$$\begin{aligned} x \quad &-0^{s}.030=v_1, \\ x \quad &-0^{s}.195=v_2, \\ x+y&-0^{s}.270=v_3, \\ x+y&-0^{s}.382=v_4. \end{aligned}$$

Giving equal weights to these equations there result

$$\begin{aligned} x&=+0^{s}.112\pm 0^{s}.048, \\ y&=+0^{s}.214\pm 0^{s}.068, \\ x+y&=+0^{s}.326\pm 0^{s}.048. \end{aligned}$$

This value of $x+y$ will be applied to the longitude differences determined in 1884, or Δl_1 . . . Δl_5 of section 16. It is the same as the correction derived above for the longitude difference determined in 1885, the only effect of the personal equation work of 1884 being to increase the probable error.

(18) *Transmission times, arrangement of circuits, and instrumental equation.*—The half sum of the transmission times, or the values of $\frac{1}{2}(x_e+x_w)$ of equation (13), shown in the last column of Table VIII, are small, being no larger, in fact, than can be safely attributed to errors in the comparison times read from the chronograph sheets and to errors in the adopted clock rates. The quantity $\frac{1}{2}(x_e-x_w)$, which appears in equation (12), may therefore be neglected as inappreciable for the personal equation work of 1885.

The half sums of the transmission times for the longitude work, given in the last column of Table VII, require for their proper interpretation certain information as to the arrangement of the electric circuits connecting Saint Louis and the several field stations. The routes of these circuits and their approximate lengths are as follows:

Saint Louis to Oswego, Kans., via Pierce City, Mo	miles	360
Elk Falls, Kans., via Kansas City, Mo	do	479
Fort Scott, Kans., via Sedalia, Mo	do	299
Springfield, Mo	do	238
Bolivar, Mo., via Springfield, Mo	do	277
Albuquerque, N. Mex., via Kansas City, Mo., and Pueblo, Colo.	miles	1,300

For the Oswego work there were repeaters at Saint Louis and at Pierce City. For the Elk Falls work there were repeaters at Saint Louis and Kansas City. For the Fort Scott, Springfield, and Bolivar work there were no repeaters. For the Albuquerque work there was a repeater at Pueblo on July 2, 14, 15, and 19, and a single circuit July 6, 7, and 8.

Taking the means of the half sums of the times contained in Table VII and condensing the information just given we have the following table of data pertaining to the transmission times for the several stations:

Transmission times, lengths of circuits, etc.

Field station.	Average value of $\frac{1}{2}(x_e+x_w)$.	Number of repeaters used.	Approximate total length of telegraph line.
	s.		*Miles.*
Oswego	+0.103	2	360
Elk Falls	0.094	2	479
Fort Scott	0.050	None.	299
Springfield	0.050	None.	238
Bolivar	0.035	None.	277
Albuquerque	0.082	1	1,300
Albuquerque	0.072	None.	1,300

The times in the second column of this table are considerable, especially for the circuits connecting Saint Louis with Oswego and Elk Falls, wherein two repeaters were used, and for the long line from Saint Louis to Albuquerque. In all cases these times involved the sums of the action times of three relays in addition to the action times of the repeaters. If we assume that the transmission time of the electric impulse is inappreciable in comparison with the action times of the relays, the above results (dividing them by 5, 5, 3, 3, 3, 4 and 3, respectively) indicate for the average action time of a relay (or repeater) intervals varying from $0^s.012$ to $0^s.024$.

The above data embrace all the observational evidence, at present available, bearing on the magnitudes of the half differences of the transmission times or the quantities $\frac{1}{2}(x_e-x_w)$ which affect the longitude differences.

From this evidence it seems practically certain that $\frac{1}{2}(x_e-x_w)$ can not in any case exceed two or three hundredths of a second, since such an amount would require an average difference in the action times of the relays concerned in sending and receiving signals as great as the total range in the average action times deduced above. For the work of 1884 the chronograph and clock relays at Saint Louis differed somewhat from those at the field stations. In 1885 the electric apparatus at Saint Louis was a duplicate of that used at Albuquerque, except as to the chronograph relay. In the latter year also the common 150-ohm main line relays used in 1884 for receiving signals were replaced by high resistance (350-ohm) relays having short hollow cores. The action times of these relays is considerably less than the action times of the common main line relay; and on account of this fact, together with the fact that the electric apparatus of the two observers differed only in the chronograph relays, it is thought that the quantity $\frac{1}{2}(x_e-x_w)$ can not be appreciable for the Albuquerque longitude. For the longitudes determined in 1884, however, the correction $\frac{1}{2}(x_e-x_w)$ may possibly amount to a few hundredths of a second, but as we can neither assign its magnitude nor sign we must regard it as a source of uncertainty and attach to it a suitable probable error. Considering, as above, that there is appreciably no probability for an actual error of $\pm 0^s.03$ from this source we shall be on the safe side in estimating $\pm 0^s.01$ as the corresponding probable error, since it would permit an actual error of $\pm 0^s.05$.

(19) *Adopted corrections for personal and instrumental equation.*—Adopting $\pm 0^s.01$ as the probable error of $\frac{1}{2}(x_e-x_w)$ for the work of 1884, we have finally, from section 17, for the corrections for relative personal and instrumental equation, or the last three terms of equation (12), the following values:

$$\text{For 1884: } P_e-P_w+y_e-y_w+\tfrac{1}{2}(x_e-x_w)=+0.^s326 \pm 0_s.049$$
$$\text{For 1885: } P_e-P_w+y_e-y_w+\tfrac{1}{2}(x_e-x_w)=+0^s.326 \pm 0^s.038$$

(20) *Adopted longitudes.*—Applying these values to the values of Δl, given in section 16, we have for the longitudes of the several field stations or piers, relative to the pier at Washington University, Saint Louis, these results:

	West of Saint Louis.			
	h.	m.	s.	s.
Oswego, Kans	0	19	36.481	±0.054
Elk Falls, Kans	0	23	55.801	±0.054
Fort Scott, Kans	0	18	00.620	±0.053
Springfield, Mo	0	12	20.009	±0.054
Bolivar, Mo	0	12	50.016	±0.067
Albuquerque, N. Mex	1	05	47.663	±0.042

The longitude relative to Greenwich of the transit pier at Saint Louis (1881 to 1884, both inclusive) has been determined by the U. S. Coast and Geodetic Survey. The adjusted value of this longitude, given on page 423 of the report for 1884 of the Coast and Geodetic Survey, is:

$$6^h\ 00^m\ 49^s.163.$$

Before the longitude of Albuquerque was observed in 1885 the pier at Saint Louis was moved 6 feet or $0^s.005$ west of its former position.

Hence, by addition, we get the following values for the longitudes of the several stations relative to Greenwich:

	h.	*m.*	*s.*
Oswego, Kans	6	20	25.644
Elk Falls, Kans	6	24	44.964
Fort Scott, Kans	6	18	49.783
Springfield, Mo	6	13	09.172
Bolivar, Mo	6	13	39.179
Albuquerque, N. Mex	7	06	36.831

Probable errors are not assigned to these results, for the reason that no probable error is given in the report of the U. S. Coast and Geodetic Survey, referred to above, for the longitude of Saint Louis. If we estimate[1] the probable error of the longitude of Saint Louis to be $\pm 0^s.05$ the probable errors of the above longitudes will vary from $\pm 0^s.065$ for Albuquerque to $\pm 0^s.084$ for Bolivar.

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[1] In the Report for 1884 of the Coast and Geodetic Survey, page 427, the probable errors of the adjusted longitudes of Washington and Cambridge are given as $\pm 0^s.042$ and $\pm 0^s.041$, respectively. The probable error of the adjusted longitude of Saint Louis must be somewhat greater than these values, though probably not quite so much greater as $\pm 0^s.05$.

TABLE OF GEOGRAPHICAL POSITIONS.

(21) Collecting the weighted mean latitudes from Table II, converting the above longitudes from time into arc, and applying the coordinates of points determined geodetically relative to the several piers, we have the following tables of geographical positions:

TABLE IX.—*Geographical positions in Kansas.*

Descriptions of points.	Latitude.			Longitude.		
	°	′	″	°	′	″
Astronomical pier, Oswego, Labette County	37	09	59.81	95	06	24.66
Northwest corner of township 33 south, range 21 east, Labette County	37	12	33.38	95	09	26.37
Southwest corner of section 6, township 33 south, range 21 east, Labette County	37	11	41.00	95	09	26.31
Spire of Methodist church, southwest corner of Second avenue and Illinois street, Oswego	37	10	13.24	95	06	32 11
Spire of Baptist church, southeast corner of Third avenue and Merchant street, Oswego	37	10	09.45	95	06	22.16
Spire on cupola of school house, block 11, Oswego	37	10	09.00	95	06	48.64
Spire on cupola of court house, northwest corner of Sixth avenue and Merchant street, Oswego	37	09	58.93	95	06	24.08
Spire on cupola of engine house, northwest corner of Sixth avenue and Commercial street, Oswego	37	09	58.80	95	06	28.66
Astronomical pier, Elk Falls, Elk County	37	22	03.64	96	11	14.46
Southeast corner of township 30 south, range 11 east, Elk County	37	23	18.08	96	08	82.13
Southeast corner section 10, township 31 south, range 11 east, Elk County	37	21	33.89	96	10	49.67
Southwest corner section 10, township 31 south, range 11 east, Elk County	37	21	33.83	96	11	55.21
Quarter section corner south side section 10, township 31 south, range 11 east, Elk County	37	21	33.82	96	11	23.45
Spire Methodist church, northeast corner of Eighth and Cherokee streets, Elk Falls	37	22	19.87	96	11	22.79
Astronomical pier, Fort Scott, Bourbon County	37	50	25.76	94	42	26.75
Spire of Congregational church, northeast corner National avenue and Orange street, Fort Scott	37	50	15.20	94	42	26.91
Spire on cupola of Central School, on square bounded by Chestnut street, National avenue, Orange street, and Judson street, Fort Scott	37	50	17.28	94	42	28.19
Stand pipe of Fort Scott water works	37	49	54.08	94	42	58.13
Flag staff in national cemetery, Fort Scott	37	49	21.14	94	41	33.04
Southwest corner of township 25 south, range 25 east, Bourbon County	37	49	13.75	94	42	48.78
Southeast corner of section 31, township 25 south, range 25 east, Bourbon County	37	49	13.79	94	41	42.71
Quarter section corner south side section 31, township 25 south, range 25 east, Bourbon County	37	49	13.73	94	42	15.84

TABLE X.—*Geographical positions in Missouri.*

Description of points.	Latitude.			Longitude.		
	°	′	″	°	′	″
Astronomical pier, North Springfield, Greene County	37	13	15.96	93	17	17.58
Southwest corner of township 30 north, range 21 west, Greene County	37	16	30.65	93	17	50.62
Quarter section corner on west side of section 1, township 29 north, range 22 west, Greene County	37	16	14.32	93	17	34.33
Flag staff on water works, North Springfield	37	14	03.26	93	17	35.36
Spire on Drury College chapel, on northwest corner of Benton avenue and Center street, North Springfield	37	13	06.66	93	17	16.74
Flag staff on Ozark Hotel, North Springfield	37	13	51.56	93	17	16.69
Center of section 13, township 29 north, range 22 west, Greene County	37	13	10.16	93	17	08.59
Spire of Catholic church, on northwest corner of East Locust and Webster streets, North Springfield	37	13	42.01	93	17	05.25
Southwest corner of section 7, township 29 north, range 21 west, Greene County	37	13	35.95	93	16	34.74
Astronomical pier at Bolivar, Polk County	37	36	35.22	93	24	47.68
Quarter section corner on south side of section 12, township 33 north, range 23 west, Polk County	37	36	48.25	93	25	31.45
Pinnacle on cupola of school house on north side of Locust street, and west of north Main street, Bolivar	37	37	01.87	93	24	47.75
Southwest corner section 1, township 33 north, range 23 west, Polk County	37	36	47.93	93	24	44.95
Southwest pinnacle on cupola of Southwest Baptist College, on square bounded by Maupin, Mill, College, and Clarke streets, Bolivar	37	36	31.34	93	24	44.78
Center of dome of court house on south side of East Main street, Bolivar	37	36	53.38	93	24	38.00
Spire of Methodist church, on east side of North street, Bolivar	37	36	58.28	93	24	34.33
Northeast corner of township 33 north, range 23 west, Polk County	37	37	38.25	93	23	35.02

TABLE XI.—*Geographical positions in New Mexico.*

Description of points.	Latitude.			Longitude.		
	°	′	″	°	′	″
Astronomical pier at Albuquerque, N. Mex	35	04	32.40	106	39	12.47
Section corner common to sections 17, 18, 19, and 20, township 10 north, range 3 east, New Mexico	35	05	13.26	106	39	35.66
Catholic church cross, on northwest corner of Copper avenue and Sixth street, Albuquerque	35	05	09.70	106	39	23.04
San Felipe Hotel flag staff, on the southwest corner of Gold avenue and Fifth street, Albuquerque	35	04	59.78	106	39	21.02
Armijo House flag staff, on southwest corner of Railroad avenue and Third street, Albuquerque	35	05	02.25	106	39	11.64
Grant Block flag staff, on northwest corner of Railroad avenue and Third street, Albuquerque	35	05	03.12	106	39	11.09

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